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Ed. Moore

Final Report
of Work Performed Under
Contract NAS2-871

for

National Aeronautics and Space Administration
Ames Research Center
Moffett Field, California

RAVEN

industries, inc.

Sioux Falls, South Dakota

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Final Report
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Balloon Flight Operations at
Goose Bay ^② ^① Final Report

National Aeronautics and Space Administration
Ames Research Center
Moffett Field, California

J. J. Kaliszewski and Emily Frisby 30 Oct. 1962
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(NASA Contract NAS 2-871)

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Annex A - Operations Plan 426-62

I. PREFACE

Letter Contract NAS 2-871 was initiated 10 May 1962, between Raven Industries, Inc. and National Aeronautics and Space Administration, Ames Research Center.

Under this contract Raven Industries, Inc. was to provide five balloons, control instrumentation, ground and airborne equipment, and services to launch, track and recover four flights. Due to the difficulty of the operation, performance was on a "best effort basis".

The estimated cost of this program was \$121,539.00 with fixed fee of \$7,500.00 for a total funding of \$129,039.00

This final report is submitted by J. J. Kaliszewski, Project Engineer for Raven Industries, Inc., and Miss Emily Frisby, Project Meteorologist (Section VI.).

II. PROGRAM OBJECTIVES

The basic objective of the balloon flight program was to expose a scientific payload of approximately 500 pounds to high energy particles at an altitude of approximately 128,000 feet for a period of 54+ hours. Goose Air Force Base, Goose Bay, Labrador, $53^{\circ}-20'N$, $60^{\circ}-25'W$, was selected as the launching site.

Upon launching, the balloons were to be tracked by aircraft throughout the flight and scientific payload recovered at termination and released to the scientific group. Recovery area was forecast to be in the vicinity of Prince Albert and Edmonton, Alberta.

Initial balloon flight operations at Goose Bay were scheduled to commence on or about 1 July 1962 with the operation to be completed within 45 days.

III. LOGISTICS

Due to the remote location of Goose Bay, Labrador, this site is served by Military Sea Transport Service and MATS. Goose Bay, due to its northerly position, opens to shipping on or about 15 June.

As a result of the bulk and weight of helium cylinders, helium trailer, and vehicle launch equipment, these items were scheduled for transportation by MSTS and this required a great deal of effort in preparation of equipment on short notice for arrival at Hampton Roads Army Terminal, Norfolk, Virginia for shipment via the SS McGraw which was loading on 1 June 1962.

Mr. F. E. DeBeVoise of Ames Research Center made all arrangements for both MSTS and MATS shipments which resulted in no delays in arrival of equipment at Goose Bay.

1. Equipment Shipped to Goose Bay via SS McGraw:

Helium tractor 51B1772, U. S. Army
Launch truck U. S. Navy #96-22747

Box #1

Spray paint (black, orange, white)
Mosquito net hats
2 cases cornstarch

Roll 500 lbs. test nylon line
30 pi-balls
2 rolls safety wire (steel)
5 rolls Beldon #14 red wire
14 rolls 890 tape
3 rolls Beldon #20 wire (yellow, blue, black)
15 rolls APV
3 tubes 3-M weather strip adhesive
1 can tite seal
2 rolls poly tape
5 rolls masking tape
5 flashlights
7 bottles leak tek
1 spool repair kit
Stationery, etc.
100 recovery tags
1 lb. water pump grease
2 large adv. end wrenches
2 pipe wrenches
Helium diffuser
6 large squib leathers
Pi-ball reel & line
Ballast strainer
Spare leather
Red wire sleeving
Helium valve
Helium manifold (2)
Band it tool
Railroad iron
Oil can
Squib can and large cannons
1/2 ton chain hoist
Small paper tags
Pig tail adapters
5 beacon battery packs
5 beacon antennas
Coaxial cable

Box #2

100' inflation hose
Cascade hose
Gauge and fitting
60 lbs. spring scale
1/2" banding and buckles
Equipment scale
3/16" aircraft cable

3/16" squeezers
1/8" aircraft cable
1/8" squeezers
1/4" aircraft cable
1/4" squeezer
Survival rations
2 46.5' dia. parachutes
Bundle rags
2 wheel chalks
1 roll 5000# test nylon line
Roll pi-ball line
1 roll 1000# nylon line
Extension cords
Poly tape
APV tape
3 lbs. hammer
Claw hammer
Masking tape
3 1/2" hose couplers
1 1" to 3/4" NPT reducers
6 spare hose clamps (squibs)
2 spare hose fittings
30 ballast can caps
5 command rec. battery packs
5 31-301 amphenol connectors
5 command rec. antennas
48 "c" cells
24 "U" - 30 cells
12 "Z" cells
48 "D" cells
12 XX9 cells
12 N-60 cells

Box #3

1200 lbs. steel shot ballast
200 ft. ground cloth
24 lbs. cornstarch
2 lanterns
1 box 412 batteries
1 box 4F cells
3 rolls mystic tape
Scrap poly
5 rolls 890 tape

Box #4

1000 lbs. steel shot ballast
200 ft. ground cloth

Black poly tarp
Griffolyn tarp
3/4 mil end roll

Box #5

9 million cu. ft. balloon

Box #6

9 million cu. ft. balloon

Box #7

2 helium manifolds with caps
36 pigtails

Box #8

1 helium manifold with caps
18 pigtails
3 manifold connector pigtails

2. Equipment Shipped via MATS, Dover Delaware:

Box #1

1 tracker beacon pack
4 back up beacon packs
1 100' roll RG58 A/V
1 hand spotlight
1 coil 2 conductor cable
1 suitcase
1 power supply
1 tube caddy
1 Mohican receiver
1 red flashing light
1 extension cord
4 15 watt H D bulbs
1 large tool box
1 small tool box
5 beacon antennas
1 tube cal sheets
1 Motorola Byers Guide
1 Radio Eng .Rd Bk
1 Radio Amature Hd Bk
5,000 lb. cannon & squibs (10 & 2 grain)
Tool box with electric drills, etc.
60' x 2000 lb. line
Diffuser and valve
Coveralls
Cable leathers
Squib leathers

Extra strapping
Extension cord
2 clipboards
2 tablets
Bandit & tool
Helium gauge
Pouring spout (for ballast)
4 - load rings
Hardware for gondola
A. C. bolts (AN4-6 & 7)
1 hammer (small)
2 extension cords with bulbs
1 1/4" electric drill
1 sideband gov. radio AM
1 Burgess Battery Book
2 rolls data
Weight 677, cu. ft. 34

Box #2
Launch spool
Weight 255, cu. ft. 55

Box #3
1 ballast container
1 Hallicrafter receiver
2 45' parachutes
8 boex batteries - 6 volt
3 12' parachutes
1 speaker & baffle
1 487 battery
Weight 551, cu. ft. 46

Box #4
2 ballast containers
3 spool wire
2 rolls wire
1 templett
1 roll antenna wire, electronics equip.
Weight 468, cu. ft. 46

Box #5
2 ballast containers
1 aircraft camera
1 suitcase
1 pair boots
Weight 365, cu. ft. 46

Box #6

1 antenna
Weight 55, cu. ft. 10

Box #7

1 balloon type 2323-541-8291, Ser. No. 107
3/4 mil poly
Weight 1320 1/2, cu. ft. 74 1/4

Box #8

1 balloon type 2323-541-8291, Ser. No. 109
3/4 mil poly
Weight 1320 1/2, cu. ft. 74 1/4

Box #9

1 balloon type 2323-541-8291, Ser. No. 108
3/4 mil poly
Weight 1332 1/2, cu. ft. 74 1/4

Box #10

1 balloon type 2333-541-386, Ser. No. 164
1/2 mil poly
Weight 120, cu. ft. 10

3. At Goose Air Force Base facilities and equipment were made available by 4082 Strategic Wing; Commanding Officer, Col. S. F. Martin and 4082 Combat Support Group commanded by Col. Wm. Williams. Col. S. F. Martin assigned Captain R. E. Birkenbuel of Training and Plans as Project Liaison Officer.

The Operations Plan 426-62 of Headquarters, 4082D Strategic Wing (SAC), APO 677 New York, New York is hereby made a part of this final report (Annex A).

IV. FLIGHT TRAIN CONFIGURATION AND LAUNCH TECHNIQUE

A downwind dynamic launch technique was used. See Figure 1 and drawing #2A-2197. In this system the payload is suspended on the launching truck. See Figure 2. The balloon was positioned upwind from the payload and the top portion held captive during the helium inflation process. When all systems are in readiness for launching the balloon is released and allowed to rise over the payload. As the balloon becomes taut and in a vertical position over the payload, a mechanical linkage was actuated so as to render the payload airborne with a minimum of shock.

V. CHRONOLOGY OF OPERATIONAL PROGRAM

The following personnel of Raven Industries, Inc. were assigned as operational personnel for the Goose Bay project. This listing indicates assignment and level of security clearance.

J. J. Kaliszewski	Project Co-ordinator	Secret
W. J. Tschetter	Instrument Technician and Tracking	Secret
R. N. Maples	Instrument Technician	Secret
G. J. Mancuso	Supervisor Balloon Launching	Interim Secret
G. T. Melsha	Balloon Launch Technician	Interim Secret
D. C. Johnson	Balloon Launch Technician	Interim Secret
E. M. Frisby	Meteorologist	Confidential

2 July 1962: By direction of Dr. Smith J. De France, Director NASA Ames Research Center, Raven Industries, Inc. was ordered to proceed to Goose Air Force Base, Goose Bay, Labrador, upon receipt of theatre clearance to commence balloon flight operations.

3 July 1962: G. Mancuso and D. Johnson departed Sioux Falls for Goose Bay via commercial air. Aero Commander #9383R arrived at Sioux Falls and was loaded with the more critical and delicate control instruments required for the program and departed for Goose Bay with E. M. Frisby and

G. Melsha as passengers. Port of entry into Canada;
Saulte St. Marie.

4 July 1962: Raven crew arrived at Goose Bay via commercial air and Aero Commander. Upon arrival reported to Captain R. E. Birkenbuel, Project liaison officer and commenced preparation of assigned work areas and unpacking of equipment.

6 July 1962: R. Maples, W. Tschetter and J. J. Kaliszewski departed Sioux Falls for Goose Bay via commercial air and arrived at Goose Bay a.m. of 7 July 1962. Scientific and operational personnel briefed by Lt. Col. Robson, 4082 Strategic Wing Plans and Training Officer, as to conduct, facilities available, and support to be provided by 4082nd.

7-11 July 1962: Equipment prepared for tracer balloon flight and first scientific flight attempt.

Protocol visits completed to Group Captain, E. Kenny, RCAF Base Commander, Goose Bay and USAF Commanders of Goose Air Force Base.

Tracking pilots attended briefing sessions in theatre operations and survival held by Squadron Leader Epps. Operations

Officer RCAF and 54th Air Rescue Squadron, MATS; commanded by Lt. Col. P. Mudge.

11 July 1962: First weather briefing held for tracer flight on 12 July. Prediction made that weather conditions would be suitable prior to sunrise at approximately 0400.

This flight had a three fold purpose:

1. To confirm wind direction and velocity at altitude.
2. To allow pilots in tracking aircraft an actual operational tracking mission and to familiarize pilots with local terrain and emergency landing fields.
3. As a dry run to re-confirm time schedules for the operational and scientific groups in preparation for the first scientific flight.

12 July 1962: Trajectory test, flight #593-R launched at 0832 EDT using 86 ft. diameter balloon. Impact area 53°-30'N, 65°-40'W. Altitude 126,000 feet. Flight terminated by radio command after 190 mile trajectory. No recovery attempt was made. Drawing #2B-2095 load altitude chart.

13 July 1962: Weather briefing held in Base Operations at 11:30 a.m. EDT. Surface winds were expected to be light, winds at altitude at not more than 40 knots, temperature at tropopause -45°C to -50°C . Tracking weather downwind did not seem to pose any special problems.

With concurrence of Tom Edwards a flight was scheduled for launch in the early morning of 14 July 1962.

14 July 1962: Flight number 594-R was launched under near perfect conditions at 0424 EDT. Due to poor weather in the recovery area, balloon flight 594-R was terminated by radio command from the tracking aircraft on 15 July 1962 after 31 hours and 42 minutes at 128,000 feet. Impact time 2315Z recovery position $53^{\circ}-55'\text{N}$, $105^{\circ}-35'\text{W}$. By use of helicopters and float aircraft, the payload was reached 3 hours and 40 minutes after impact by Dr. W. Haymaker. See figures 3 and 4. Upon opening the capsules, the biological specimens were found to be dead, due to failure in life support system. The capsules were retrieved, flown to Edmonton, Alberta, crated and shipped to Ames Research Center. Trajectory drawing 2B-2132-2, flight altitude profile drawing 2X-2089.

19 July 1962: Raven recovery crews returned to Goose Bay to stand by for the next flight.

Due to failure of the lift support system, scientific personnel under the direction of Mr. Tom Edwards, Project Director, initiated corrective redesign of the complete life support system and proceeded with local system tests. Mr. Edwards felt that a complete altitude and environmental check of the system was required prior to another flight and requested release of the Aero Commander tracking aircraft for transportation of capsule and personnel to McDonnell Aircraft Company, St. Louis, Missouri. Release authorized.

30 July 1962: Tracking aircraft, capsules and personnel returned from St. Louis, with information that altitude tests were successful and equipment was ready for further flights. A detailed weather briefing was held at 9:30 p.m. EDT, when it was suggested that the early hours of 1 August 1962 would be suitable for launch. Winds at altitude were forecast to be 090° at 40-50 knots. Tropopause winds were not expected to exceed 35 knots and no particular problems were seen. Weather in the recovery area was forecast to be suitable, with conditions between Goose Bay and Great Whale poor due to a low pressure ridge coming in.

Per agreement between J. J. Kaliszewski and Mr. T. Edwards, a flight was scheduled to commence at 2000 hours 31 July 1962 with take-off in the early hours of 1 August 1962.

31 July 1962: Raven crew ordered to stand by for flight 595-R and proceeded with check out of instrumentation, prepared to receive capsules at 2000 hours EDT.

1 August 1962: Wind velocities had decreased and surface conditions were excellent for launch at approximately 0000 hours. After several delays capsules were delivered and released to Raven Industries, Inc. at 0230 EDT. Rigging was completed and entire group stood by due to wind velocities which had increased over the earlier period. By 0445 EDT the surface winds decreased to optimum conditions and flight train lay out began.

At 0623 EDT Flight 595-R was launched under ideal conditions. After floating at 128,000 feet for 48 hours and 38 minutes the flight was terminated on 3 August 1962 at 1306Z. Impact point 54°-10'N, 105°-14'W, which is north of Prince Albert, Saskatchewan. With the aid of helicopters and a float aircraft, scientific personnel were placed at the capsule

1 hour and 20 minutes after impact. Contents of spheres alive and intact. See Figures 5 and 6. No damage sustained. Scientific payload removed by float aircraft and released to NASA personnel for trans-shipment to Ames Research Center. Trajectory drawing 2B-2134-2, flight profile drawing 2X-2092.

5 August 1962: Recovery crew and scientific personnel returned to Goose Bay. Flight preparations began for Flight 596-R. Weather today poor. Jet stream directly over Goose Bay at velocity of 150+ knots with forecast that little change would be taking place in the next three days.

7 August 1962: A detailed briefing was held at 1300 EDT. It was tentatively suggested that the night of 8 and 9 August would give us the required conditions for the next launch. Crews were alerted, with the meteorologist to continue observations around the clock.

8 August 1962: The weather watch maintained over the night of 7-8 August indicated that a jet stream over Goose Bay was not moving out as rapidly as forecast, therefore, a 24 hour postponement was recommended, and Flight 596-R launch was rescheduled for the night of 9-10 August. Tracking conditions downwind were not expected to be difficult.

9 August 1962: Layout on west ramp for Flight 596-R was begun at 1900 EDT. Wind at initial inflation was 5 mph with occasional gusts to 8 mph. Near completion of the inflation process the wind increased to 10 mph but held steady. This wind condition was of great concern as it exceeded operational conditions required.

Launch was effected at 2045 EDT after a 15 minute delay due to an alert scramble which took place. No difficulties were encountered on take-off.

11 August 1962: Weather conditions west of Goose Bay deteriorated very rapidly. The tracking aircraft encountered a very severe thunderstorm area and took a fix on the balloon 54°-10'N, 89°-25'W at 1855Z. The balloon was at 130,000 feet, according to beacon data, performing as programmed, and the tracking aircraft skirted the thunderstorm area and landed at The Pas, Manitoba, to refuel and prepare to pick up the balloon on the back side of the front.

At 2330Z, the aircraft approached the projected trajectory at the north end of Lake Winnipeg and picked up the balloon signal which indicated that the balloon was at 80,000 feet and was descending at 300 feet per minute. Due to the

severity of thunderstorms in the area a fix could not be made on the signal. The tracking aircraft remained in the area until the balloon descended to 50,000 feet at which time the aircraft left the area due to lack of fuel and returned to The Pas. Trajectory drawing #2B-2139-2, flight profile drawing #2X-2094.

After refueling and checking winds aloft, the crew estimated that the balloon and capsules would impact SE of God's Lake. A search area was plotted and the Aero Commander, with the addition of a float-equipped Beaver from Lamb Flying Service, proceeded to the search area. Additional search aircraft were requested and authorized by Dr. Dale Smith and Mr. Tom Edwards.

12 August 1962: The Aero Commander remained in search area for approximately 4 hours and then was ordered to return to Goose Bay for the next flight.

The float aircraft continued search of plotted area with John Webster, Cessna 180 recovery pilot, as observer and remained airborne until darkness set in.

13 August 1962: Float aircraft moved search area south and operated from Northern Fishery Factory base at Island Lake, covering area east of the operating base.

Department of Transport was notified of No Track and loss of balloon. Department of Transport in turn alerted all aircraft and resort operators to be on the look out for the balloon and payload. Radio stations also included the alert in their newscasts of 12 and 13 August.

Upon completion of their search in the Island Lake area, the float aircraft was ordered to abandon further search efforts and return to The Pas.

Upon arrival at The Pas a sighting of a balloon was reported by one of Don Lamb's employees at Drunkin Lake (north of Lake Winnipeg) heading 240° about 2100 CST on 11 August 1962. If our balloon had proceeded in flight as planned it could very well have been over this area at the time the observation was made.

As a result of this sighting, hope was renewed and Dr. Dale Smith and Mr. T. Edwards requested that a search be conducted west of The Pas to Prince Albert.

14 August 1962: As a result of the reported sighting, the area between The Pas and Prince Albert was searched using Lamb's Norseman and Raven Industries' Cessna 180, with Al Clark, and Neal Eskins as observers. No further sightings were reported and the search proved fruitless. Upon request of Mr. T. Edwards the search was abandoned.

14 August 1962: The Aero Commander arrived at Goose Bay after delay enroute at Kapushkasing due to poor weather.

Weather briefing was held and satisfactory conditions for a launch were forecast at about midnight of the 14th, but would be of short duration. Therefore, the scientific group was requested to have the gondolas delivered to the flight group by 2100 EDT of the 14th.

15 August 1962: Capsules were delivered to the flight group at 0215 EDT. By this time a high pressure ridge which maintained light winds from 2100 EDT on the 14th to 0100 on the 15th deteriorated and winds increased beyond maximum operational requirements and the flight was cancelled. Mr. Tom Edwards requested that the crew stand by in hopes that the weather situation would improve. At 0535 EDT,

a light rain was falling and the flight was cancelled and standby abandoned.

15 August 1962: A weather briefing was held at 1315 EDT with the forecast that suitable launch conditions would be present between 0600 and 1800 EDT on the 16th. A second briefing was held at 1700 EDT reconfirming the earlier forecast.

16 August 1962: Capsules arrived early and layout for Flight 597-R began at 0900 EDT. Surface winds during layout were 3 to 4 miles per hour. At initial inflation, a gusty condition developed with gusts of 10 to 12 miles per hour for a period of 2 to 3 minutes which made the bubble difficult to control and the help of untrained personnel was used. No apparent damage was noted upon visual inspection of the bubble except some stretch marks at the extreme top which did not appear to be serious. Winds again calmed to 3 to 4 miles per hour and inflation completed.

Launch was made at 1124 EDT under ideal conditions. Ten minutes after launch the balloon ascent slowed down to 300 feet per minute and ballast was dropped to increase

the rate of rise. It was apparent at this time that the balloon was leaking and not performing properly. Presumably, the balloon had sustained undetected damage during the inflation process. Two hundred-forty pounds of ballast was dropped over a period of 1 hour and 20 minutes without correcting the performance of the balloon. Trajectory drawing 2B-2133, flight profile drawing 2B-2093.

The 54th Air Rescue Squadron was alerted for the planned abort, and termination of Flight 597-R was made by radio command. The flight impacted at 52°-04'N, 59°-26'W and the payload was recovered by helicopters and rescue personnel of the 54th Air Rescue Squadron commanded by Lt. Col. Parker Mudge. All scientific equipment was recovered and returned by 2000 EDT and released to Mr. Tom Edwards. Due to weight limitations on the helicopter only the critical control components of Raven Industries were returned.

17 August 1962: Weather briefing held at 2230 EDT.

Weather conditions were reported to be deteriorating rapidly with the change in season from summer to fall, with chances of good conditions in launch and recovery areas becoming slim and periods of acceptable launch conditions further apart and shorter. However, due to

a stagnant trough of low pressure in the area it was felt that it might be possible for a launch on the early hours of the 19th.

18 August 1962: Crews were alerted and stood by, winds slackened as forecast; however, an unforecast drizzle also occurred, and at 0500 EDT flight was cancelled for an indefinite period.

Weather briefing held at 1330 EDT and same conditions were forecast. It should be stated that these were not desirable conditions but the best of generally poor conditions. If the program were of indefinite duration no consideration would have been given for an attempt under these conditions. Mr. Tom Edwards requested that the operations group stand by under these conditions and the contractor agreed to comply, both parties understanding the risks involved.

19 August 1962: A weather briefing was held at 1330 EDT in the presence of Mr. Tom Edwards and J. J. Kaliszewski. It was pointed out by Miss Frisby that:

1. No weather conditions suitable for a refly could be expected in the foreseeable near future. Quebec and Labrador would be dominated by an active low pressure system which would maintain fresh winds and instability for several days.
2. Labrador weather is fast moving and suitable conditions would occur sometime if the program were prepared to wait long enough, though the chance of getting optimum conditions for all phases of an operation were now slender and would be getting more so with each passing week.
3. While waiting indefinitely for surface conditions to be favorable, the time of wind reversal aloft would also be getting closer.
4. The strength of the jet stream was becoming an increasing hazard.

At the end of this interview it was agreed that the program would terminate on 21 August and that all equipment and crews would be maintained on a standby basis on the flight line for the remainder of the period in the hope that suitable conditions might at some point allow a launch to be made.

Shortly following the conclusion of this meeting it was noted that the wind was decreasing and Tom Edwards requested that an immediate attempt for a launch be made. All personnel proceeded to the flight line.

Winds were slackening with a slight drizzle and were down to 4 to 5 miles per hour, however, they were variable in direction, shifting every few minutes. This caused a delay in train layout of about one hour.

At 1600, after a conference between J. J. Kaliszewski and Mr. Tom Edwards, it was agreed that the risk of a launch would be undertaken. Winds slowed down to 4 to 7 miles per hour at 165°-180°. Inflation began. At about the 50% inflation point, the wind began building up with gusts to 12 - 15 miles per hour, with a wind shift to approximately 030°. Balloon buffeting in the platform became violent and, while attempting to protect the balloon from beating itself on the launch vehicle cab, the balloon was punctured. It was felt that the balloon film could be patched if the wind subsided and patches were prepared; however, the wind increased to 20 - 24 miles per hour again beating the balloon against the vehicle. During this time several

large holes were torn in the balloon. The balloon was now damaged beyond the point of repair and was ordered cut down at 1730 EDT.

20-21 August 1962: All equipment remaining was packed and prepared for shipment on GBL for water transport via the SS Boice.

20 August 1962: The Aero Commander with W. Tschetter, R. Maples, and Miss Frisby returned to Sioux Falls, South Dakota.

22 August 1962: The balance of Raven personnel returned to Sioux Falls, South Dakota.

VI. METEOROLOGICAL REPORT - Operation of Balloon Flights

A. Introduction

The meteorologist assigned to the Project arrived on the Air Base at Goose Bay on 4 July 1962 with the advance Raven Industries' party. A few days had been requested in which to make a thorough investigation of the data resources of the Department of Transport Main Meteorological Office, and a study of local weather and Base topography, prior to the commencement of operations.

Meteorological facilities were found to be excellent. They were used gratefully and extensively throughout the program, by courtesy of the Director, Mr. H. Gerger and his most cooperative staff.

Local weather was found to approximate closely to that of Sydenham Airport, on the shore of Belfast Lough, Northern Ireland, - an area familiar to the writer as a result of war time experience on another Continent, but in a similar latitude and with like exposure.

Time was also needed for the preparation of a briefing room. The Air Weather Service came nobly to the rescue in this regard. Captain David Richardson did a fine job of preparing and erecting wall boards for chart material in the basement of Base Operations and all was in readiness for the first briefing by 10 July.

B. Topography and Summer Weather

Goose Bay, at about 53°N, lies in temperate latitudes, where synoptic systems are fast moving and weather rapidly changing. Circulation round the northern hemisphere slows up considerably during the summer months. It is nevertheless rare for an anti-cyclone to center itself on Quebec and Labrador, and provide, for any length of time, the quiet conditions considered desirable for stratospheric balloon launch operations.

During the summer period late June, July and early August, local and diurnal weather effects are very marked. Icebergs are drifting southward off the Labrador coast and all coastal and inland water areas are still very cold. This is in strong contrast

to the temperature of the land, especially of the sandy areas which surround Goose Bay.

The Goose Air Base lies between the Goose and Hamilton Rivers. Both drain northeastward into Lake Melville and the Atlantic Ocean. Mountainous country bounds the airstrip on north, south, and east sides. General alignment of the topography is southwest to northeast.

The most noticeable effects of topography on local weather are as follows:

1. Winds are funnelled southwest to northeast and northeast to southwest along the valleys, following the overall alignment of the physical features.
2. Sea breeze effect is added to the gradient wind on sunny afternoons. All easterly and southeasterly winds get pulled round to the northeast and their strength increased at least five to ten knots when sea breeze and funnelling are added to the strength of the gradient wind.

There is usually a delay in the drop of wind strength after sunset, so that in uncomplicated summer conditions, the calmest hours are around and after midnight.

3. Cloud amount exerts a marked effect on wind strength on the airport. The moment the sun appears between two banks of cloud, the wind can be expected to increase in strength. This is particularly noticeable at sunrise and sunset.
4. As the result of marked differences in temperature between air over a cold sea and that over warm sand, fog is a persistent feature of the summer months along the coast. Fog and low stratus blown inland by northeasterly winds, can be expected to and do persist over the Air Base for much of the morning.

C. Analysis of a Balloon Flight Forecast

Each balloon flight forecast involves not one but a series of forecasts:

1. A forecast of conditions for the launch itself.
2. A forecast of conditions from the surface through the tropopause to stratospheric flight altitude.

3. A forecast of conditions at altitude governing the trajectory.
4. A forecast of conditions for balloon descent, in the forecast recovery area.
5. An aviation forecast for the flight tracking aircraft from launch point to and including the recovery area.

D. Criteria for a Balloon Flight Forecast

Weather criteria for a balloon flight vary, to some extent according to considerations of balloon type and size, the nature of the payload, and the length of time involved in inflating the bubble.

Due to the large size of the balloons used in the Goose Bay program, the costliness and delicacy of the capsule load, the possible delay of launch time due to traffic, and the need for at least two hours on the strip for layout and inflation, the following criteria for the Goose Bay project were agreed upon:

1. Winds at the surface must be consistently less than 8 mph and preferably less than 5 mph, for a minimum of 4 hours.

2. Winds at the tropopause must be less than 50 knots with no serious shearing between the surface and jet stream levels or above.

Other desirable features were:

1. Winds as light as possible at altitude, to give maximum possible flight time.
2. Cloud cover as light as possible. (Restrictions on cloud cover for the launch were relaxed by the Department of Transport to allow a balloon operation to take place in completely overcast conditions if need be. It was nevertheless preferable to try to find periods when light winds synchronized with small amounts of cloud.)
3. Clear conditions in the recovery area with no particular hazards for parachute and load descent.
4. Safe operating conditions for the tracking aircraft, across the expected trajectory.

Thus, optimum conditions for the various phases of each operation could be formulated as follows:

1. For the launch: A period of at least 4 hours, of winds as close to calm as possible, but certainly less than 8 mph, no precipitation and as little cloud cover as possible.
2. For the lift to altitude: Jet stream winds less than 50 knots. No radical change in direction or shearing effects, from the surface to the tropopause. Temperatures higher than -68°C . (Since tropopause temperatures above Goose Bay were consistently above -68°C throughout the period of the project, no further mention is made of them in this report.)
3. For the flight at altitude: Easterly winds as close to 090° as possible and light enough to allow 50 to 60 hours at altitude.
4. For the descent and recovery: Clear, light wind conditions, 2 to 3 days after launch, in the projected recovery area.
5. For the tracking aircraft: Flying conditions across an approximate 2,000 mile route that will allow constant radio contact with the balloon to be maintained.

The number of occasions when all these conditions are co-existent at this latitude is very limited, even in the

height of summer. Every effort was made, therefore, not to miss one chance of a launch during those periods when gear was ready to be flown.

F. Weather Briefings

A weather watch was kept continuously between 4 July and 2 August, 1962. Canadian Department of Transport weather observations, both surface and upper air for the whole of Canada were constantly under review.

The only data which were not available in Goose Bay were wind direction and strength at flight heights. These were obtained by telephone, following Arcas Rocket firings at Wallops Island, Virginia, on Wednesday and Friday during each week of the project. Stratospheric wind data from Wallops Island were supplemented by the receipt of information concerning flight trajectories of Raven balloons from Ft. Churchill, in the course of a program that coincided to some extent with the one at Goose Bay.

A summary of rocket wind information received from Wallops Island between 11 July and 17 August 1962,

is shown in Figures 1 and 2, Section VI.

Tracer Flight

The first briefing was held in the afternoon of 11 July, prior to the projected launch of a tracer balloon on the 12th. An Atlantic anticyclone was maintaining a tight ridge of high pressure along the coast of Labrador. It seemed likely that the anticyclone would soon begin to extend westward over the landmass and that as it did so, the gradient wind would slacken in the Goose Bay area. A launch time close to dawn was suggested. It was expected that winds would be lightest just prior to sunrise and begin to increase thereafter. It was also expected that, since surface winds would be northeasterly, there would be a lot of cloud.

Both expectations were justified. Winds were less than 10 mph by 0400, and there was an almost total stratus cover.

The tracer was launched successfully at 0832Z on 12 July. An interesting lesson in sensitivity was learned during the filling of the bubble. The sky

ROCKET WIND SPEEDS BETWEEN 100,000 & 130,000 FEET WALLOPS ISLAND, VA. 11 JULY TO 17 AUGUST 1962

JULY 1962

AUGUST 1962

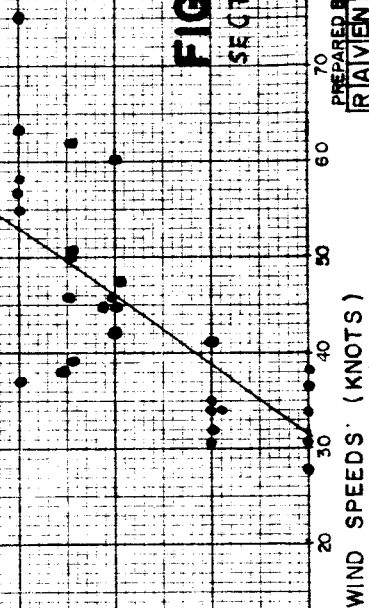
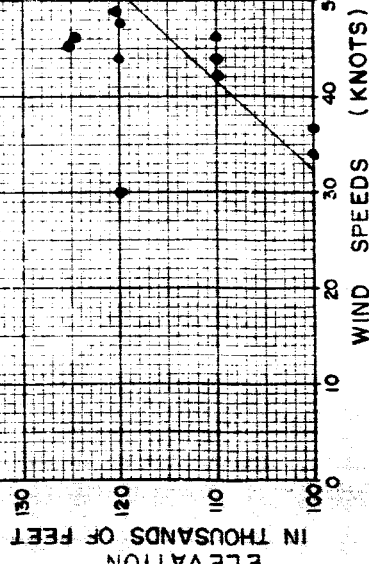


FIGURE 1
SECTION VI

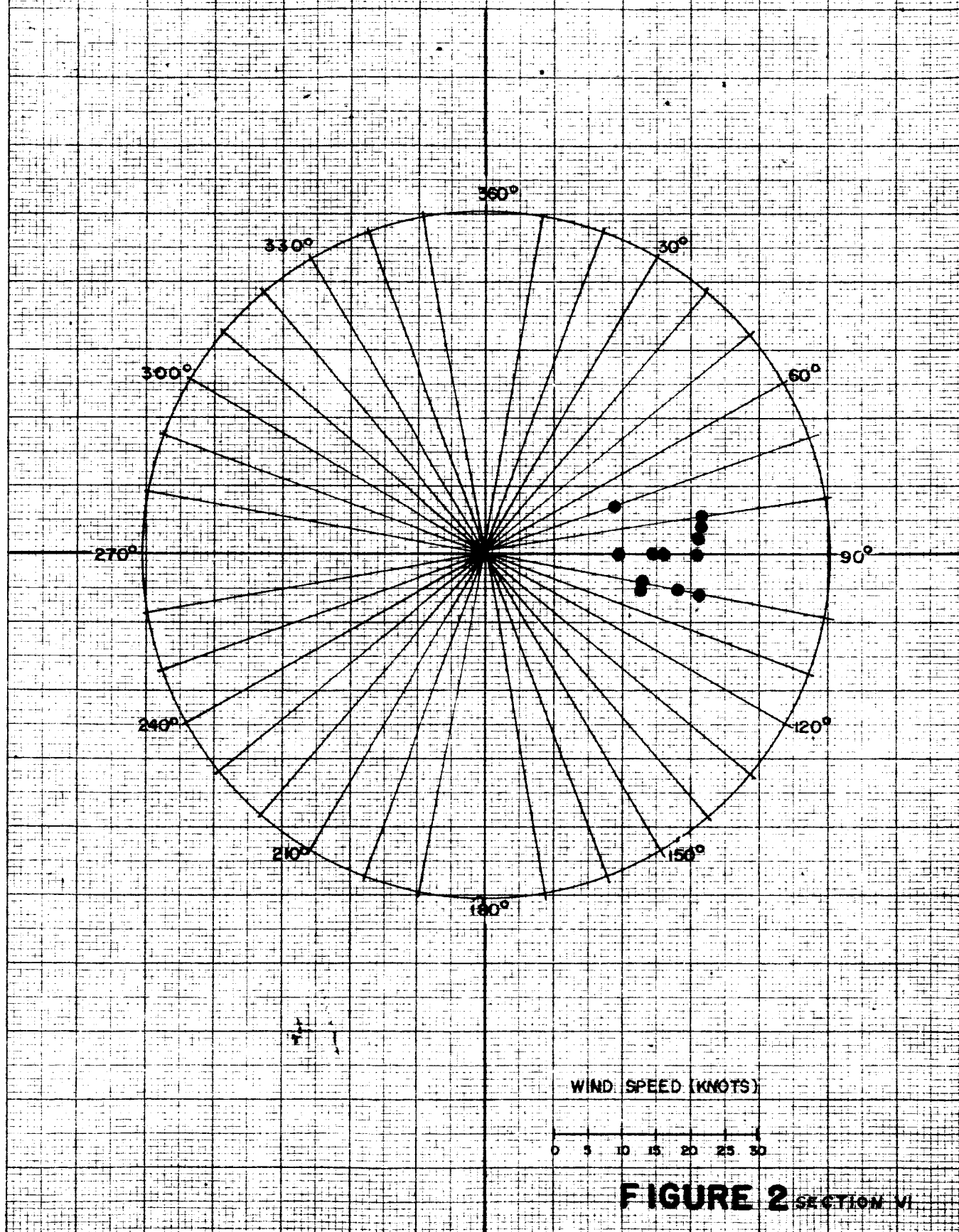
cover of scud did not quite reach the ground along the eastern horizon. The sun appeared in this crack for a few minutes and immediately the wind rose. It slackened off again however just as quickly, at which time the cloud extended down to the horizon and cut off the sun.

Monkey Flight 1

In an informal briefing at 1115Z, on 13 July, it was slated with confidence that conditions would be suitable for a launch at 0600Z on 14th.

A more detailed briefing was given at 1430Z. A north Atlantic anticyclone was drifting westward and it seemed likely that its open center would be over Goose Bay within 24 hours. Winds were expected to be light southeasterly at the surface and easterly not more than about 40 knots, at the tropopause. At altitude, Wallops Island data suggested winds would be easterly at about 50 knots. Tropopause temperatures were -45°C to -55°C . Tracking weather did not seem likely to pose insurmountable problems.

ROCKET WINDS AT 125,000 FEET DIRECTION AND SPEED, WALLOPS ISLAND, VA. 11 JULY TO 17 AUGUST 1962



A beautiful launch was made at 0730Z on 14 July in perfect conditions of calm wind and no cloud. Figure 3, Section VI. After this first major flight, and its successful recovery, there was a pause for about ten days while the capsules were being re-conditioned and tested in St. Louis. Everything was in gear again, however, by 30 July.

Monkey Flight 2

A detailed briefing was held between 0000Z and 0100Z on 30 July, when it was suggested that the early hours of 1 August would be suitable for a launch. A ridge of high pressure lying northeast across Quebec and Labrador was expected to maintain light winds on Goose Bay Air Base until the morning of 1 August.

Winds at altitude were forecast to be 090° at about 40-45 knots. Winds at the tropopause were not expected to be more than about 35 knots and no particular problem was seen with regard to wind direction up to altitude or for the tracking pilot in the recovery area, though tracking weather from Goose Bay to Great Whale would not be good.

(A low pressure system was replacing the ridge of high and moving towards the Labrador Coast from the west.)

No recheck was made but it was recognized that it would be as much as could be hoped for to hold light winds in the Goose Bay area until the early hours of 1 August. Capsules reached the hangar by 0530Z on 1 August (instead of the scheduled 2300Z of the night before) and a beautiful launch was finally made at 0930Z in excellent conditions. Figure 4, Section VI. A successful recovery was made during the morning of 3 August, in the vicinity of Prince Albert, Saskatchewan as before.

Monkey Flight 3

Weather broke up after 1 August, and several days were involved in recovery and return of the Flight 2 load.

Thus the opportunity for launching the third load was not looked for until after 6 August.

A detailed briefing was held at 1600Z on 7 August, when it was suggested tentatively that the night

8/9 August would give the required conditions. A cold anticyclone was moving eastward from Hudson Bay. The first taste of fall was being experienced. The polar front moved to a position south of the Great Lakes; a large body of cold air in the form of a vast anticyclone moved to a central point southeast of Hudson Bay with the arctic front north of it over Northwest Territories and northern sections of Hudson Bay. The polar front jet stream was almost overhead. Two wind-speed maxima, one between 20,000 and 30,000 feet another between 30,000 and 40,000 feet appeared in the upper air ascent at Goose Bay and at Nitchiquan. In addition, fresh southerly winds were observed in the Goose Bay sounding above 100,000 feet on 8 August and winds above 100,000 feet at Nitchiquan also were by no means consistently from the east.

The anticyclone moved into the Quebec area more slowly than had been anticipated. Consequently, a 24 hour postponement of launch time was recommended, to allow: the jet stream to move south of Goose Bay

so that tropopause winds which had been close to 150 knots would be less than 50 knots; the ascent to altitude to be more regular; Goose Bay to be closer to the center of the anticyclone than to the ridge on its periphery, and more up-to-date observations on high stratospheric winds to be received. This would have brought the launch to the night 9/10 August, but an evening launch on the 9th was hoped for, although it was stressed again that surface winds at Goose Bay were unlikely to be at a minimum until well after sunset.

Features of this briefing included:

1. Good tracking conditions across the anticyclone, but developing weather problems in the recovery area.
2. Marginally fresh winds for the launch till around midnight.
3. Satisfactory wind strength and direction from the surface to altitude.
4. Easterly winds 30 to 40 knots between 120,000 and 130,000 feet.

Winds at altitude were derived from balloon trajectories out of Ft. Churchill. Raven Industries, Inc. program for Office of Naval Research Contract NONR 3390(05). No Wallops Island winds were available at this critical time.

The sensitive relationship between wind strength and sunshine was shown again during the inflation. When the setting sun appeared for a few minutes between two banks of cloud, wind that had dropped to 5 to 8 mph increased to 10 mph and remained at that strength until launch. Release took place at 8:45 p.m. only after time had been allowed for several aircraft to leave the runway. Figure 5, Section VI.

Unfortunately, conditions on the west side of Canada had deteriorated during the two days of tracking so that by the time the Gods Lake area was reached, it was found to be dominated by giant thunderstorms. The balloon signal was lost and tracking could not be continued. The balloon could not be located on the west side of the storm area, and its load was not recovered.

Monkey Flight 4

Once the recovery crew was back in Goose Bay, opportunity for Flight No. 4 was looked for.

A forecast of satisfactory conditions for the launch around midnight on 14th was made on 13 August.

The capsules were scheduled to be in the hangar by 9 p.m. Unfortunately they did not arrive until 0515Z on the 15th. By this time, the high pressure ridge which had given light winds at the surface from 0000Z to 0400Z was beginning to tighten, and it was most unlikely that winds would remain light for the period of the inflation. The flight was cancelled.

Another briefing was held at 1615Z on 15 August when it was forecast that a narrow ridge of high pressure would provide suitable launch conditions between 0900Z and 2100Z on the 16th.

This forecast was repeated at 1700 on the 15th.

This time the capsules were ready early and movement of the ridge slowed down. Winds dropped at about 1200Z however, conditions stabilized, and a perfect

launch was made in complete calm at 1424Z
on 16 August.

Unfortunately, this balloon failed to reach
altitude, had to be cut down, and its load
recovered.

Recovery was effected by 0000Z of 17 August,
and an opportunity for reflly was discussed at a
briefing at 0100Z of 17th. Progression of summer
into fall in Labrador was beginning to make the
chance of getting all the necessary weather
conditions concurrently, very slim. But at
a briefing at 1630Z on the 18th, it seemed reasonable
to expect that surface winds would remain slack
in a stagnant trough of low pressure long enough
for an inflation to be made, in the early hours of
the 19th.

Winds certainly slackened before midnight as
forecast. But unfortunately some unforecast light
drizzle also occurred. Since winds would inevitably
increase in the rear of this very unstable system by
about 0800Z the flight was regretfully cancelled for
an indefinite period.

At 1630Z on the 19th a final briefing was held in the presence of Mr. T. Edwards and Mr. J. Kaliszewski.

It was pointed out that:

1. No suitable weather conditions for a refly could be expected in the closely foreseeable future. Quebec and Labrador would be dominated by an active low pressure system which would maintain fresh winds and instability over the airport for several days.
2. Labrador weather is fast moving and suitable conditions would recur sometime, if the program could be extended long enough, though the chance of getting optimum conditions for all phases of an operation was now slender and would be getting more so with each passing week.
3. By waiting indefinitely for surface conditions to become favorable, the time of wind reversal aloft was getting closer.
4. The strength of the jet stream was becoming an increasing hazard.

At the end of this review it was agreed that the program would terminate on 21 August and that all gear would be maintained

on a standby basis for the remainder of the period in the hope that suitable conditions might at some point last long enough to allow a launch to be made.

Following this decision to go on standby, and without further briefing, layout and inflation were started at the request of the Project Director at 4 p.m. on the 19th, when instability was at a maximum, but at a moment when winds were uneasily light, in a temporary lull between heavy showers. After about one hour however, more shower cloud came over, wind rose from 5 to 24 knots and the balloon had to be cut down on the launch pad.

The project was over.

Note: As forecast, there was no period between 19 and 21 August, when winds were light enough over an interval long enough, for a successful launch to be made.

G. Recommendations

Certain recommendations for future projects in the Labrador vicinity may be drawn from Goose Bay experience in 1962.

The gradual onset of fall in early August and the difficulties experienced in finding good conditions for a fourth launch, argue an earlier start to the program on any future occasion.

It is suggested that the preparation period start on about 7 June, and the operational dates be from 15 June to 7 August.

It is most likely that in this latitude there will be considerable variation from year to year in time of onset of the summer season, as well as in the number of favorable operational occasions. Nevertheless, it is expected that this recommended period of seven weeks will provide all that is best in the short Labrador summer.

H. Acknowledgements

Although a general Acknowledgements Section appears at the end of the main report, a few words of thanks and appreciation are here proffered to personnel of the Air Weather Service, and especially to Captain David Richardson, for help in the preparation of premises for briefing; to personnel of NASA's Rocket

Windfinding Unit at Wallops Island without whose data, trajectory forecasts would have been hazardous indeed; and in supreme measure to Dr. McTaggart Cowan, Director of the Canadian Meteorological Service, Toronto, Canada and to Mr. H. Gerger and all his staff at the Main Meteorological Office, Goose Bay, for the benefit of their data resources and the cheerfulness of their cooperation.

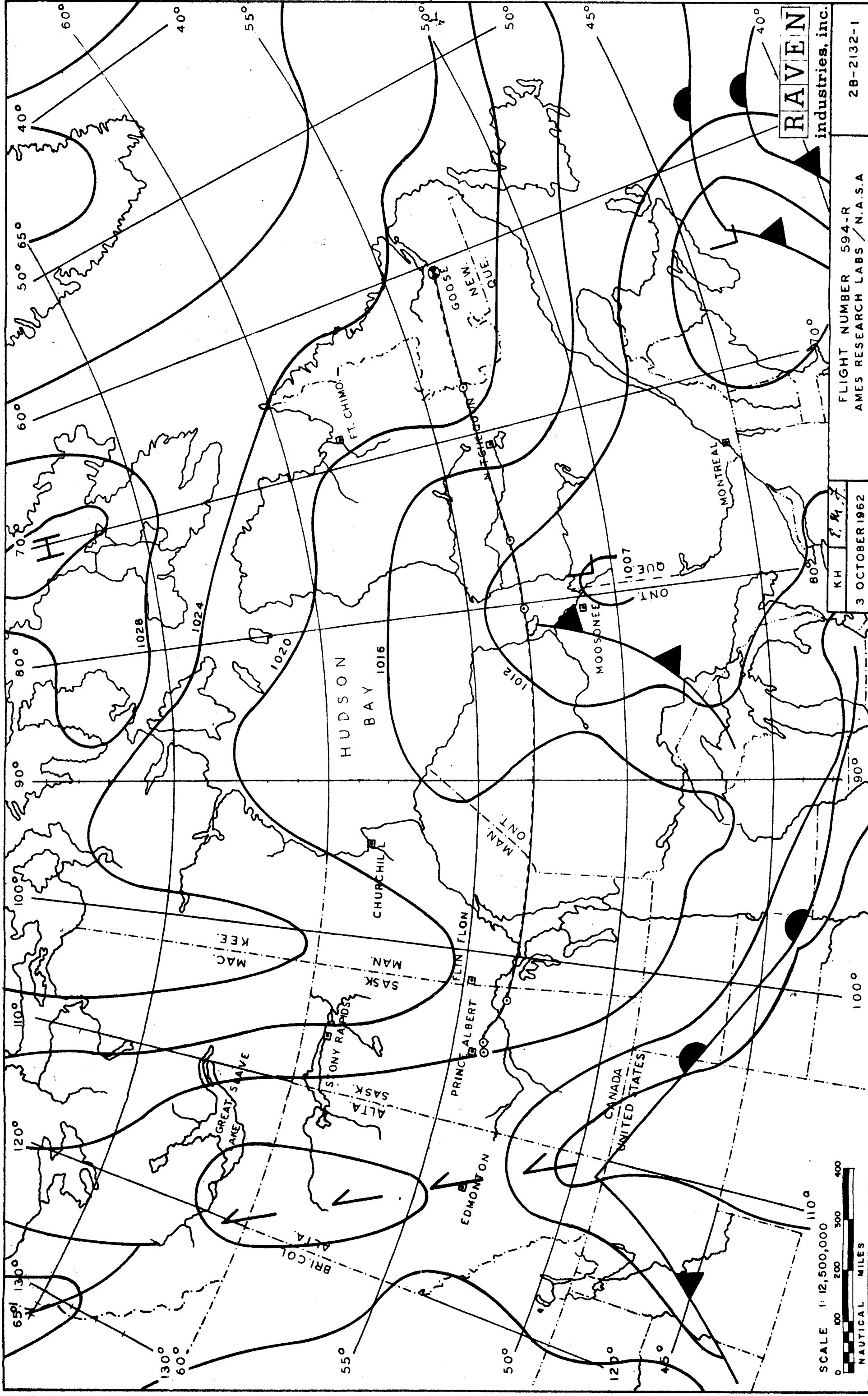
Balloon Flight Schedule Goose Bay, Labrador. July and August 1962

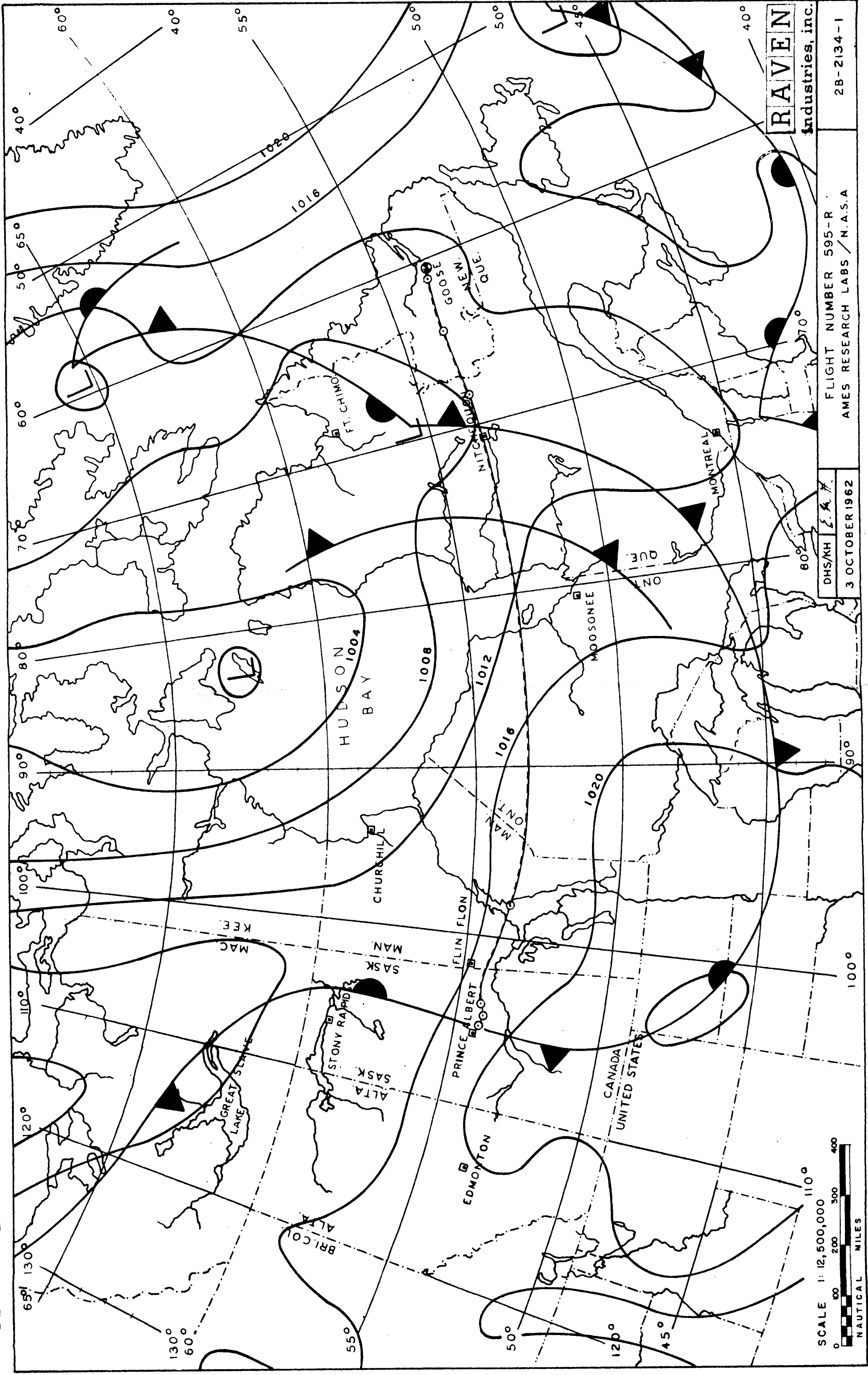
Flight Number	Date	Launch time	Type of flight	Balloon size (cu.ft.)	Theoretical ceiling	Time at Altitude	Impact Time	Location of Recovery	Notes
593R	12 July	0832Z	Tracer	600,000	128,000	4 hours	1320Z (40)	53°45'N 62°50'W	Entirely satisfactory balloon operation.
594R	14 July	0730Z	Monkey flight 1	9,000,000	128,000	31 hours 42 min.	15/2315Z	53°59'N 105°36'W	Entirely satisfactory balloon operation and recovery.
595R	1 Aug.	0923Z 0600Z	Monkey flight 2	9,000,000	128,000	48 hours 38 mins.	03/1306Z	54°10'N 105°14'W	Entirely satisfactory balloon operation and recovery.
596R	9 Aug. 10	2341Z 10/0000Z	Monkey flight 3	9,000,000	128,000		Last fix 11/1855Z	54°20'N 89°25'W	Entirely satisfactory launch. Balloon lost in severe thunder- storm.

Flight Number	Date	Launch time	Type of flight	Balloon size (cu. ft.)	Theoretical ceiling	Time at Altitude	Impact Time	Location of Recovery	Notes
597R	16 Aug.	1424Z	Monkey flight 4	9,000,000	128,000	1 hour	16/1642Z	52°04'N 59°26'W	Entirely satisfactory launch. Balloon failed while rising. Balloon cut down Damaged as a result of wind increase during inflation.
600R	19 Aug.	1900Z	Monkey flight 5	9,000,000					

Weather briefings in connection with this series of operations were held whenever an operation was projected.

They usually took place in the basement room in Base Operations prepared for this purpose. But more informal briefings were also held in BOQ 568 and in the Officers Club.







VII. RECOMMENDATIONS

Due to the shortness of the Labrador summer season any future operation contemplated for this area, should be planned to start on or about 1 June. This recommendation is covered in detail in the meteorological report. This means that heavy equipment would need to be flown in or even brought in by sea in the previous shipping season.

Long duration tracking of balloon flights across the Canadian wilderness area during this operation indicates that a long range, all weather aircraft is desirable, both for safety of operation and personnel efficiency. Provision should be made for at least two full crews on board.

The use of amphibious aircraft was investigated, primarily the SA-16, which is used by the U. S. Coast Guard and Air Rescue Service. Investigation with both branches of service indicate that over oceanic bodies of water this aircraft is suitable but that over the Canadian wilderness it was not recommended for the following reasons:

1. Large bodies of water are required for takeoff and landing.

2. Draft of the SA-16 is 4 feet on takeoff and 5 feet on landing.
3. Canadian lakes are often strewn with large hidden boulders, and landings might be of emergency nature with little chance of getting out again.
4. Range is limited to 8 hours at normal cruise and maximum of 12 hours at minimum cruise.
5. It is not an economical operating aircraft.

An aircraft considered ideal for this operation is a C-54, radar equipped and with long range fuel tanks and crew bunks installed. This aircraft would have the all weather capability of operating through thunderstorm areas, keeping track of the balloon under all conditions and provide the personnel the added safety of multi-engine operation.

The number two choice for the escort aircraft is a C-47 equipped for long range operation with radar. This of course is more suitable for short field operation and is the least costly of the two aircraft recommended in both maintenance and cost per hour of operation, yet maintaining the safety aspects of the operation.

Our recent operation illustrates that if proper advance planning is carried out local operators in the impact area can be used for the final recovery operation.

Perhaps better, if the operation were planned far in advance a government-owned aircraft could be secured on bailment to a contractor for operation on this type of program. If sufficient funding were available, it would be feasible to equip this aircraft, or even the tracking aircraft with aerial recovery gear. An aircraft equipped with aerial recovery would not be dependent upon additional recovery crews in the forecast impact area. It would not be necessary to cut down the flight short of projected flight duration due to deviation in trajectory which might put it over terrain not readily accessible for ground recovery.

VIII. PATENT REPORT

All balloon construction techniques, command and control instrumentation and operational procedures used in this program were of standard, proven character. No new designs were developed and no patents are being filed as a result of this work.

IX. ACKNOWLEDGEMENTS

The conduct of the Goose Bay flight program was dependent upon the assistance of many groups and associated personnel.

The contributions of time and effort of these groups and personnel are gratefully acknowledged.

1. National Aeronautics and Space Administration,
Ames Research Center, Moffett Field, California,
sponsor.

Dr. Webb Haymaker, Director Ames Research Center.

Dr. Dale Smith, Ames Research Center.

Mr. Tom Edwards, Project Director, Operation Goose Bay, Ames Research Center.

✓ Mr. F. DeBeVoise, Logistics, Ames Research Center.

2. USAF, Goose Air Force Base, Goose Bay, Labrador.

Col. S. F. Martin, Commander, 4082nd Strategic Wing (SAC) APO 677, New York, New York.

Col. William Williams, Commander, 4082nd Command Support Group.

Lt. Col. S. Thompson, Headquarters 4082nd Strategic Wing (SAC).

Lt. Col. Parker Mudge, Commander, 54th Air Rescue Service (IMATS).

Capt. Richard E. Birkenbuel, Training and Plans, Headquarters, 4082nd Strategic Wing (SAC).

Lt. Col. F. Rehak, Commander, 1623rd Support Squadron.

C/M/Sgt. J. C. Morgan, 1623rd Support Squadron.

Major E. D. Whitely, Commander, 1623rd Transportation Squadron.

Captain R. H. Taylor, 1623rd Transportation Squadron.

Captain D. Richardson, Air Weather Service,
Goose Bay.

3. The Canadian Government for the use of their air space and country for these experiments.
4. Royal Canadian Air Force, Goose Bay, Labrador.

A special acknowledgement to Group Captain, E. Kenny, Commander RCAF Goose Bay whose special considerations and help greatly contributed to the project.

Squadron Leader Russell Hammond, ATC, RCAF.

Squadron Leader R. Epps, Operations Officer,
RCAF.

5. Department of Transport

Mr. H. Gerger and staff, main meteorological office,
Goose Bay.

Mr. George Machum, Air Traffic Control, Goose Bay.

6. NASA's Rocket Windfinding Unit, Wallops Island.

It is impossible to adequately acknowledge the many contributions made by many other personnel not listed. To these many thanks.

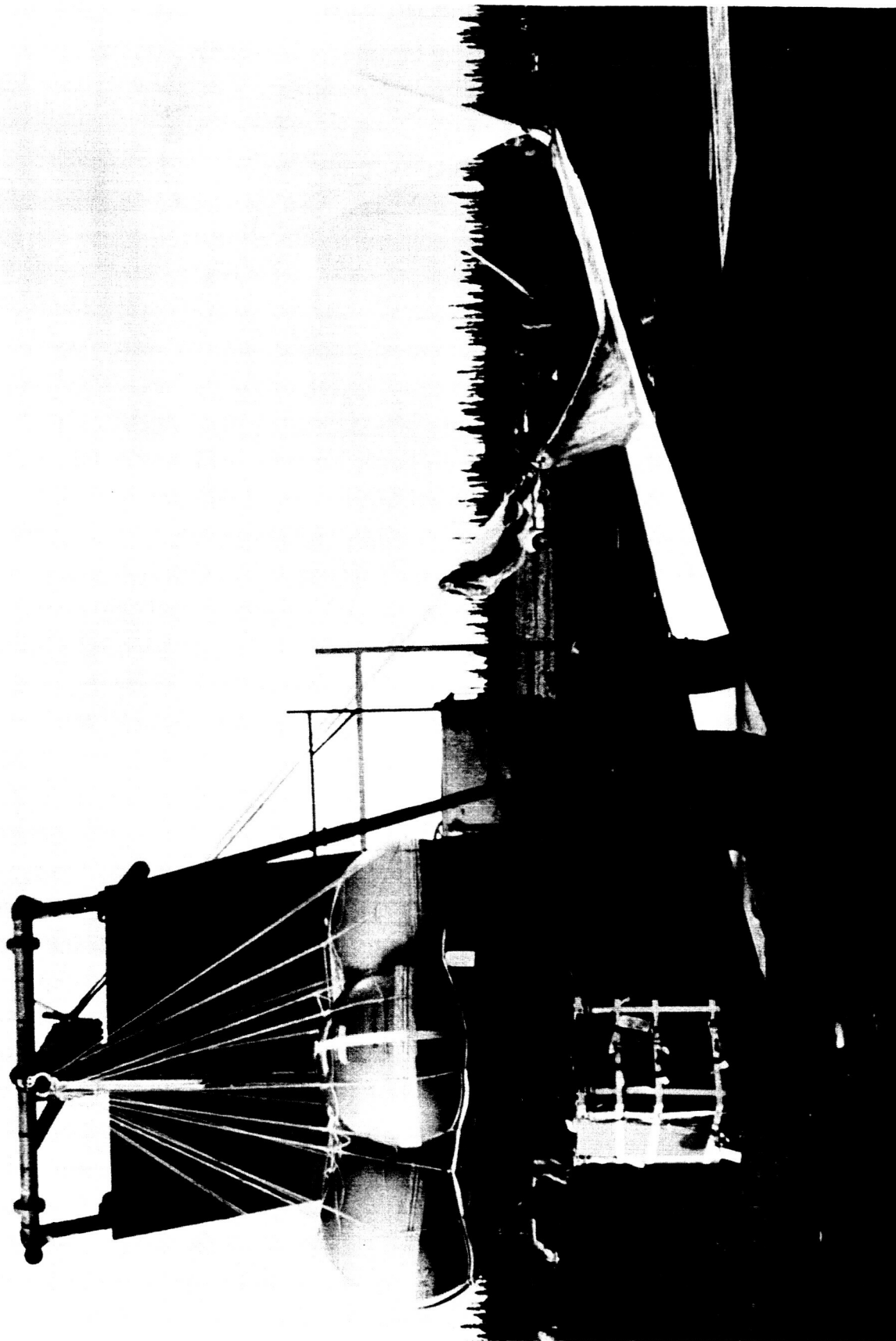
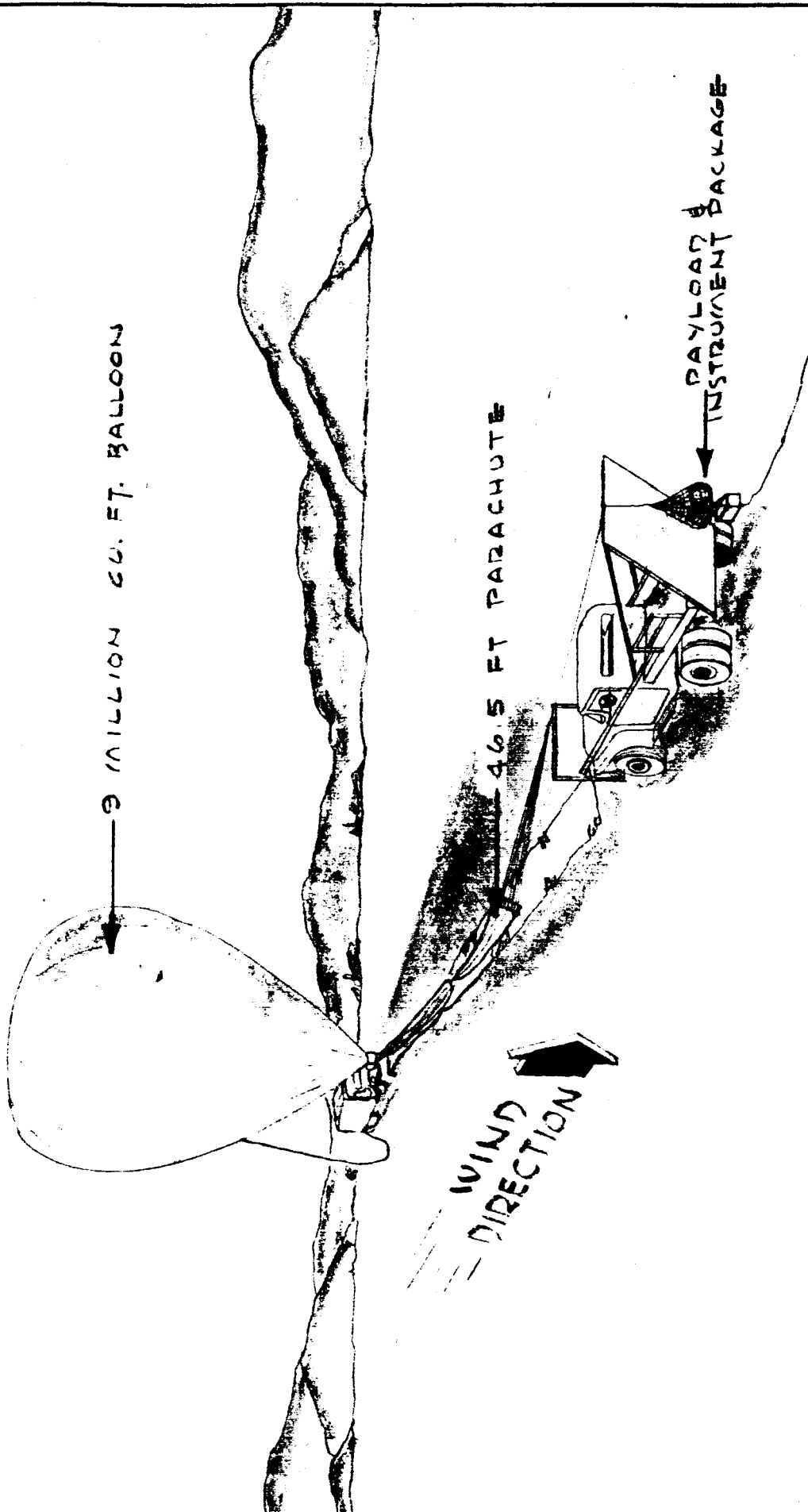


Figure 1

The balloon used to carry animal and micro-biological experiments across Canada is shown just prior to take-off at Goose Bay, Labrador. In the foreground is the payload consisting of four capsules.



MATERIAL	DATE 18 OCTOBER 1962	TITLE		RAVEN industries, inc.
	DR <i>DmL</i>	FLIGHT TRAIN CONFIGURATION		
	CHK	SCALE NONE		
	APPO	DWG NO 2A-2197		

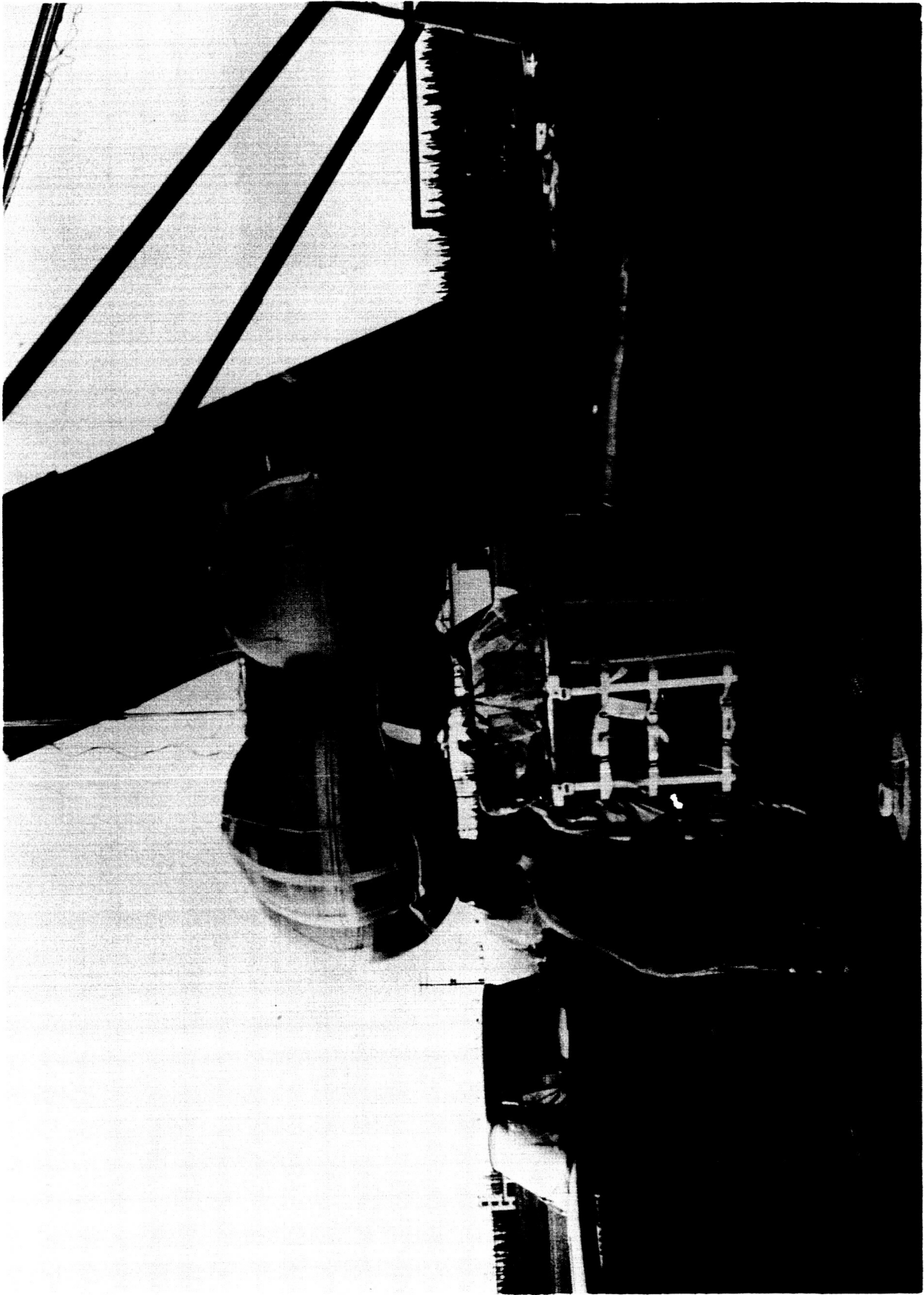


Figure 2

T R A C E R FLIGHT NO. 593-R

DATE: 12 JULY 1962
FOR: PROJECT 281
AMES RESEARCH
LABS
N. A. S. A.

BALLOON

TYPE: 2333-541-286
VOL: 250,000 CU.FT.
MATL: .50 MIL POLY
WT: 58.0 LBS.

LOAD FACTORS

AWLOAD: 21.5 LBS
GROSS LD: 79.5 LBS.
FREE LIFT: 25.8 LB=27%
BALLAST: NONE



R A V E N

industries, inc.

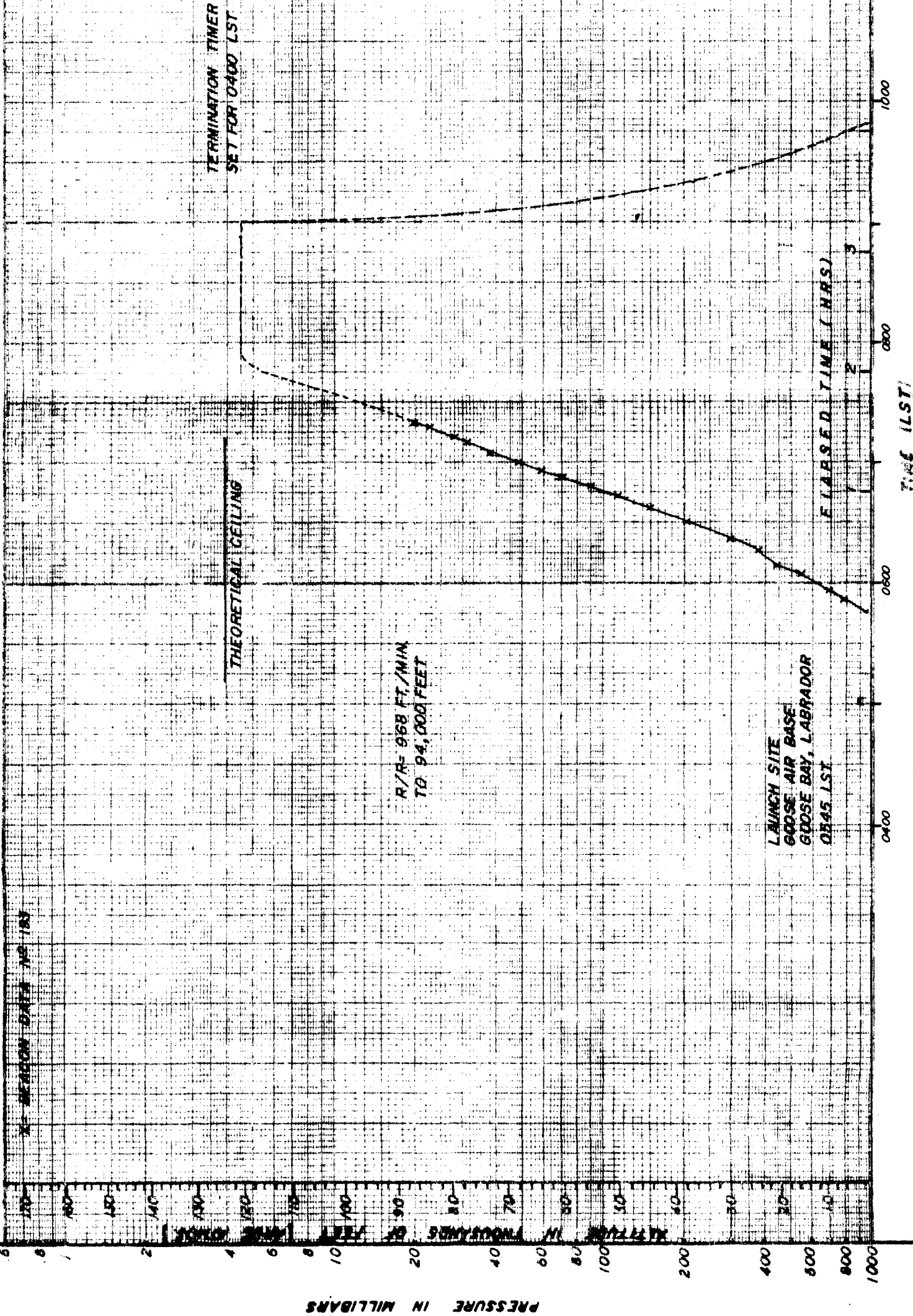
DR D6K 26 SEPTEMBER 1962

CHK: *[Signature]*

APP: *[Signature]*

2B-2095

75-1000 DATA NO. 183





The white spot marks the payload parachute under which are the capsules. One of the recovery planes landed on the nearby lake in Saskatchewan, Canada, to recover the capsules. This was photographed by the tracking plane which followed the balloon across Canada.

Figure 3

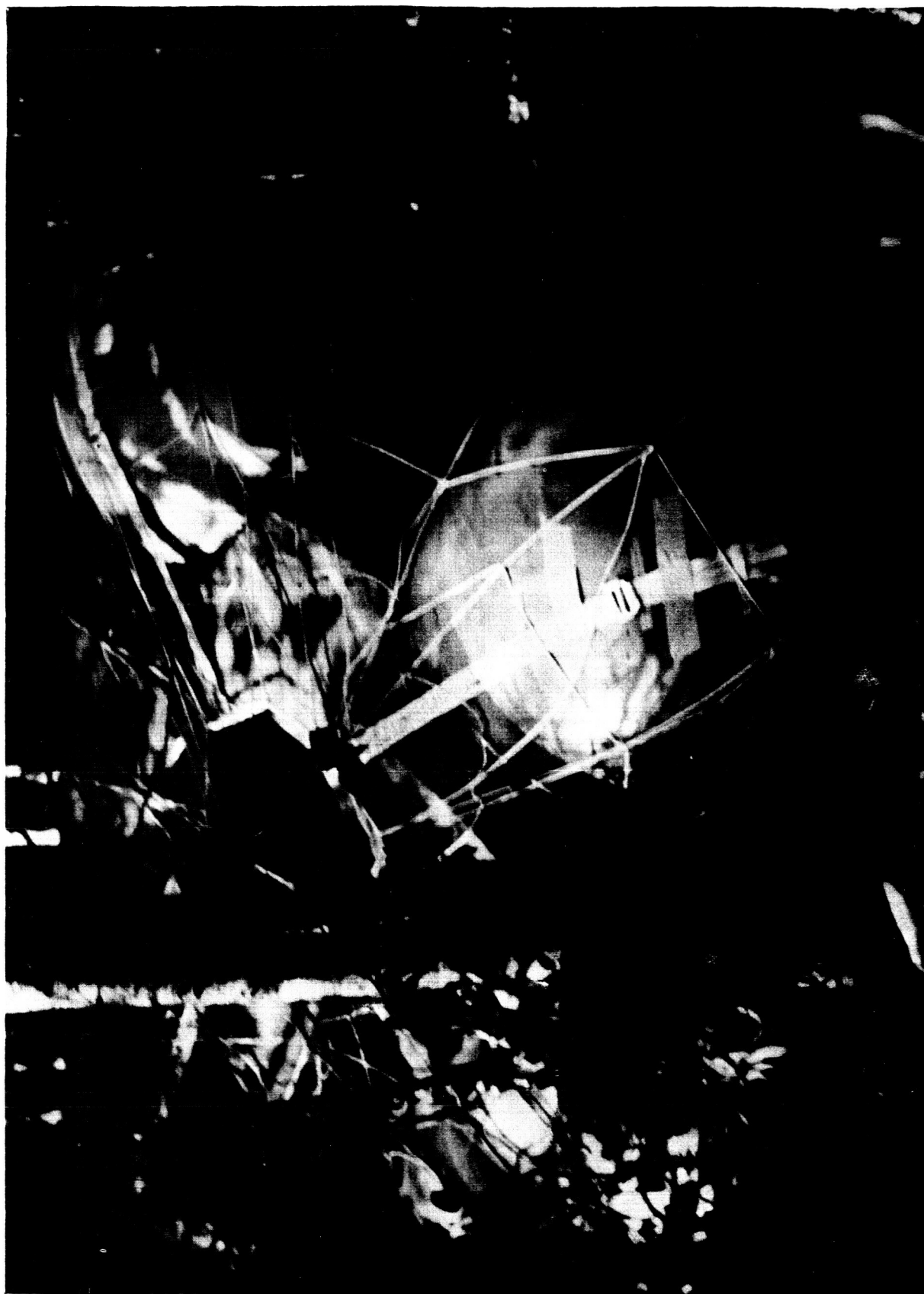
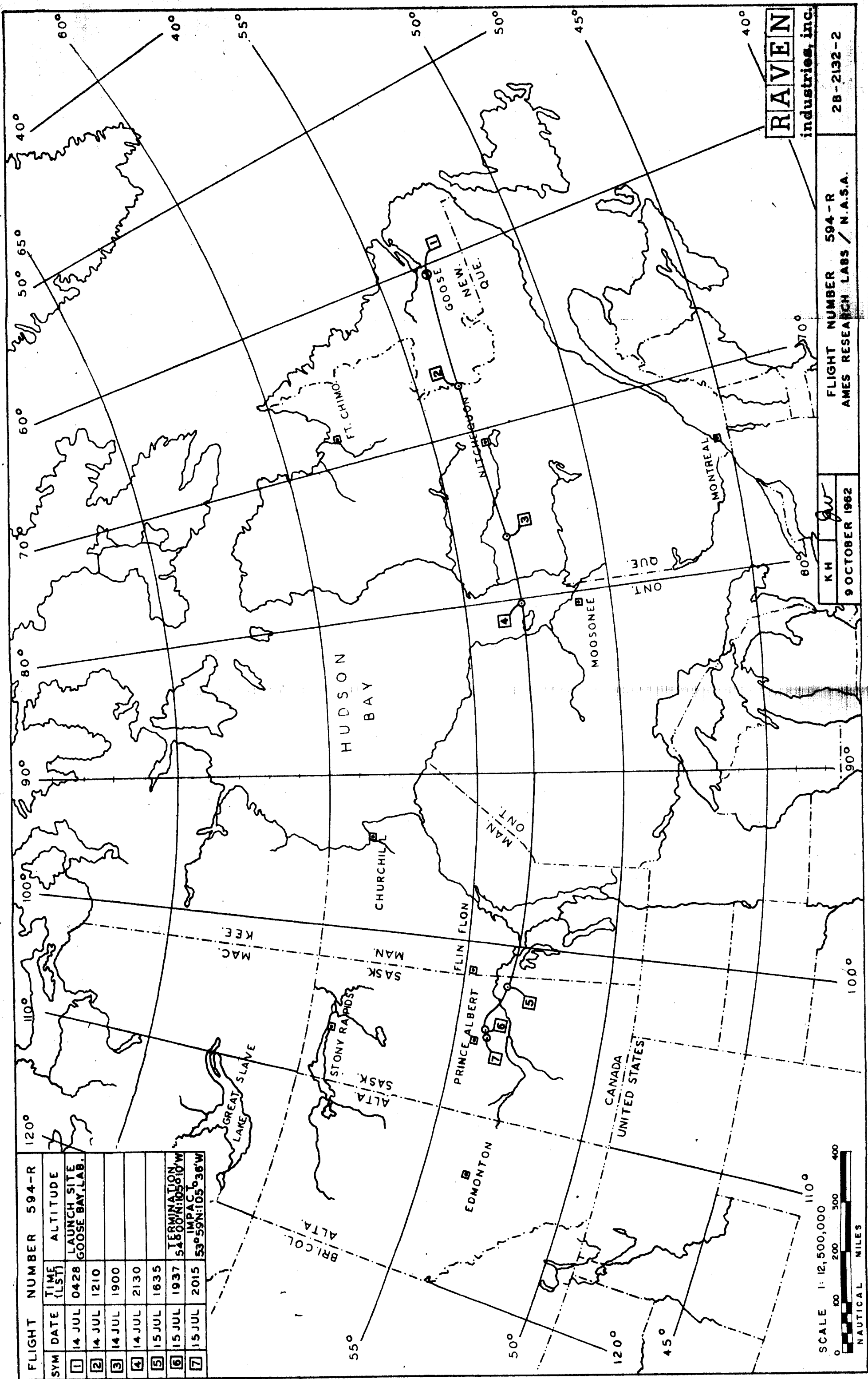


Figure 4

The payload consisting of four capsules strapped together is shown in the heavily-wooded area of Saskatchewan Province of Canada shortly after being cut-down from the balloon.

FLIGHT NUMBER 594-R			TIME (LST)	ALTITUDE
SYM	DATE			
1	14 JUL	0428	LAUNCH SITE GOOSE BAY LAB.	
2	14 JUL	1210		
3	14 JUL	1900		
4	14 JUL	2130		
5	15 JUL	1635		
6	15 JUL	1937	TERMINATION 54°00'N:105°10'W	
7	15 JUL	2015	IMPACT 53°59'N:105°36'W	

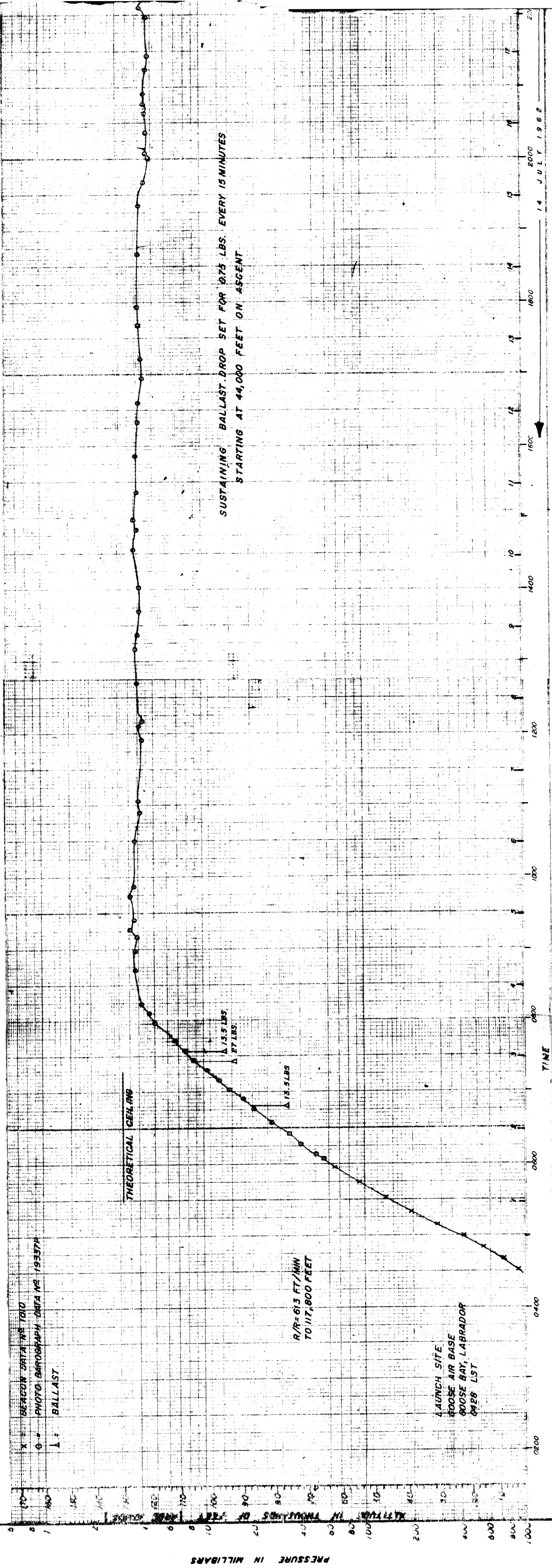


RAVEN
industries, inc.

FLIGHT NUMBER 594-R
AMES RESEARCH LABS / N.A.S.A.

KH ☒ 9
9 OCTOBER 1962

SCALE 1:12,500,000
0 100 200 300 400
NAUTICAL MILES



FLIGHT NO. 594-R

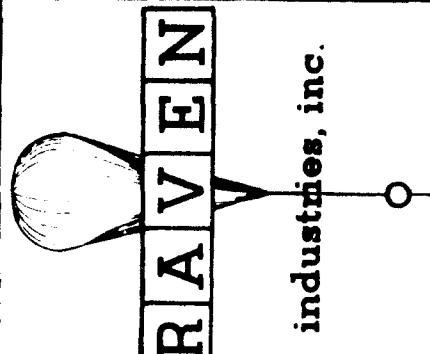
DATE: 14 JULY 1962
FOR: PROJECT 281
AMES RESEARCH
LABS
N. A. S. A

BALLOON

TYPE: 2323-541-8291
VOL: 9 MILLION CU FT.
MATERIAL: 75 MIL POLY
WT: 998.5 LBS.

LOAD FACTORS

AVG LOAD: 1051.0 LBS.
GROSS LD: 2049.5 LBS.
FREE LIFT: 225LB-11%
BALLAST: 400.0 LBS.

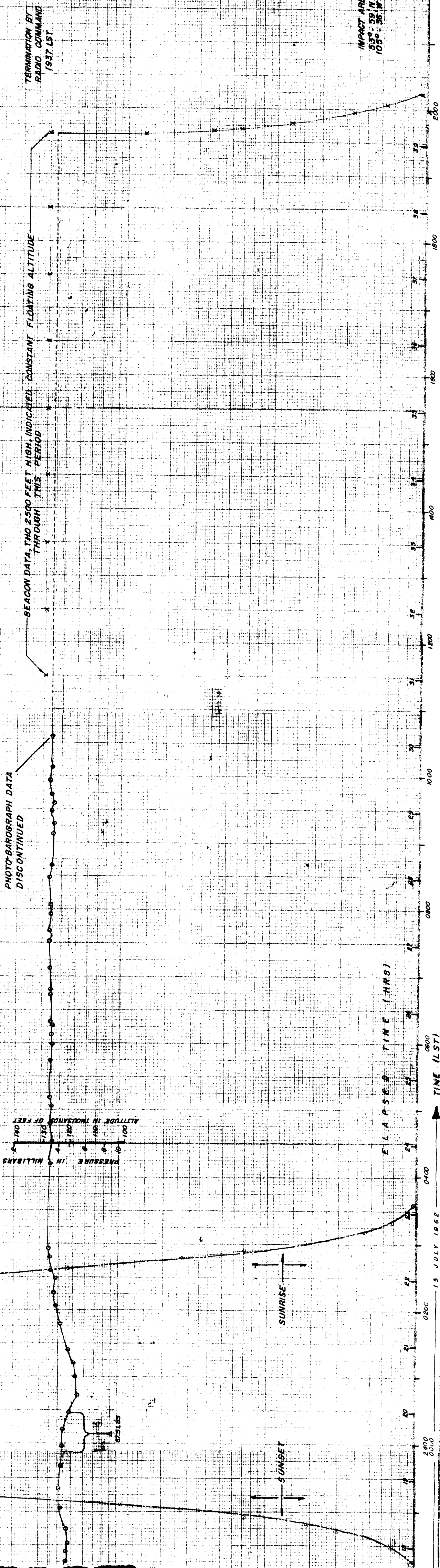


DR. DSK 26 SEPTEMBER 1962

C.M. *[Signature]*

APP. *[Signature]*

2X-2089



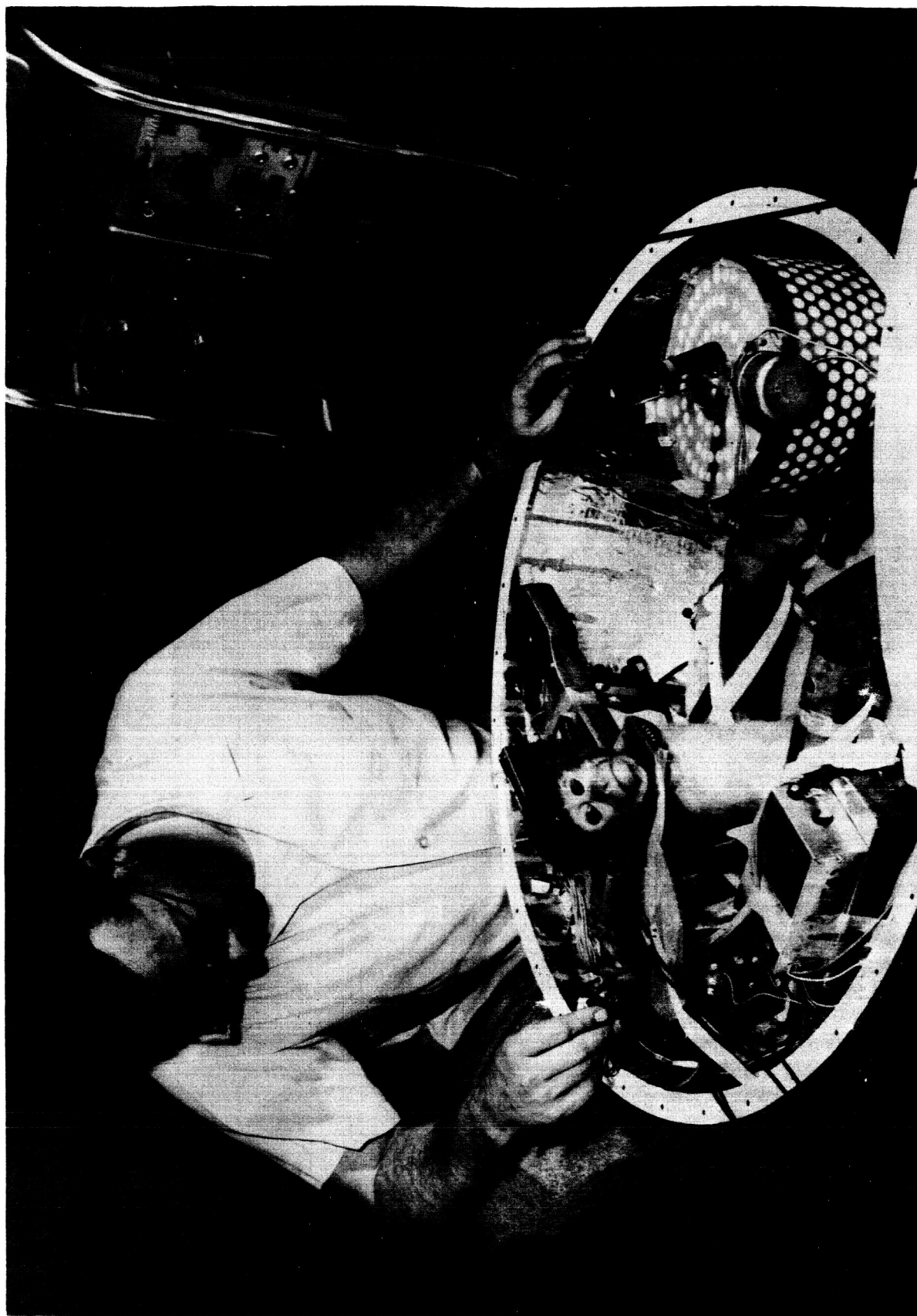


Figure 5

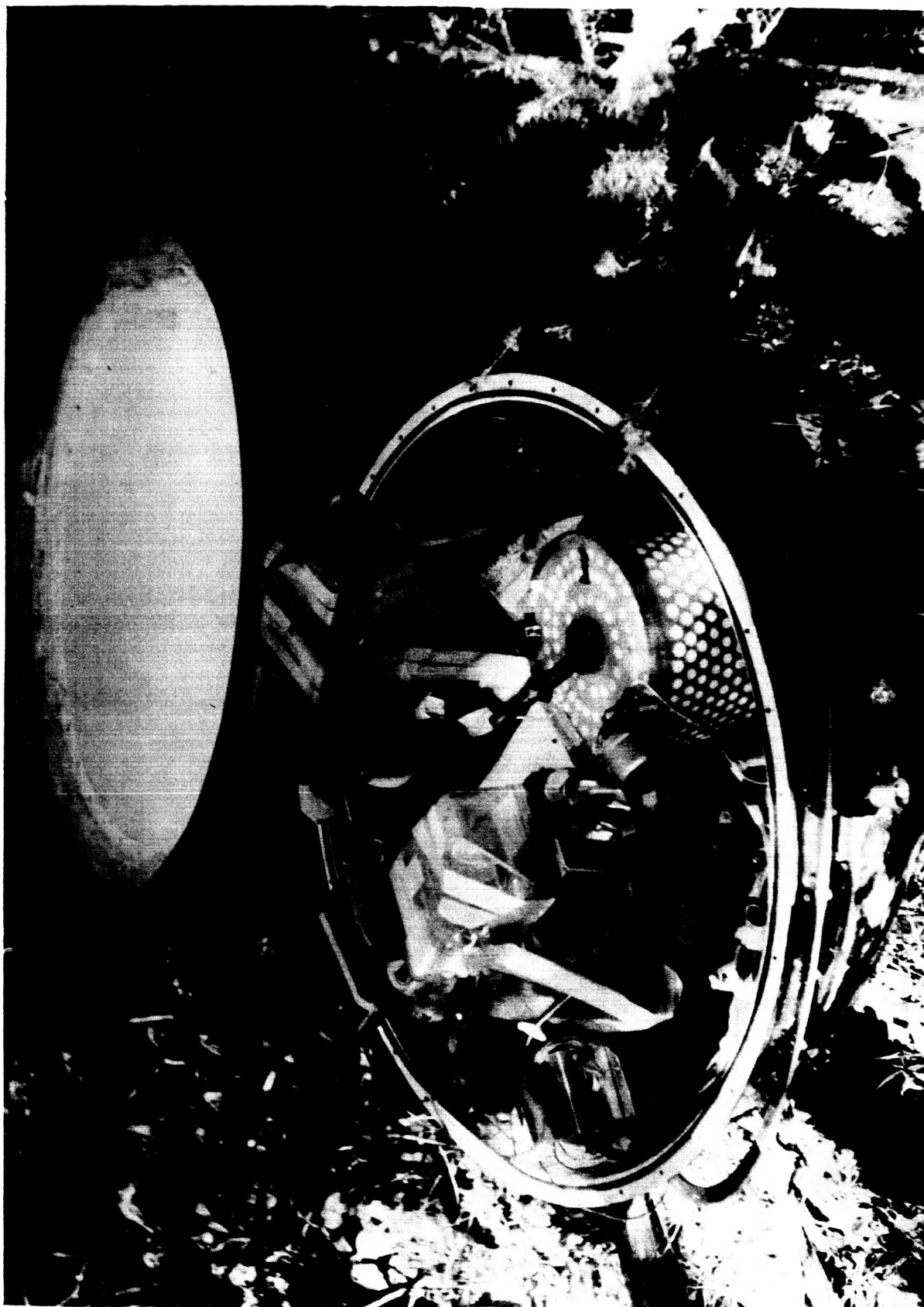
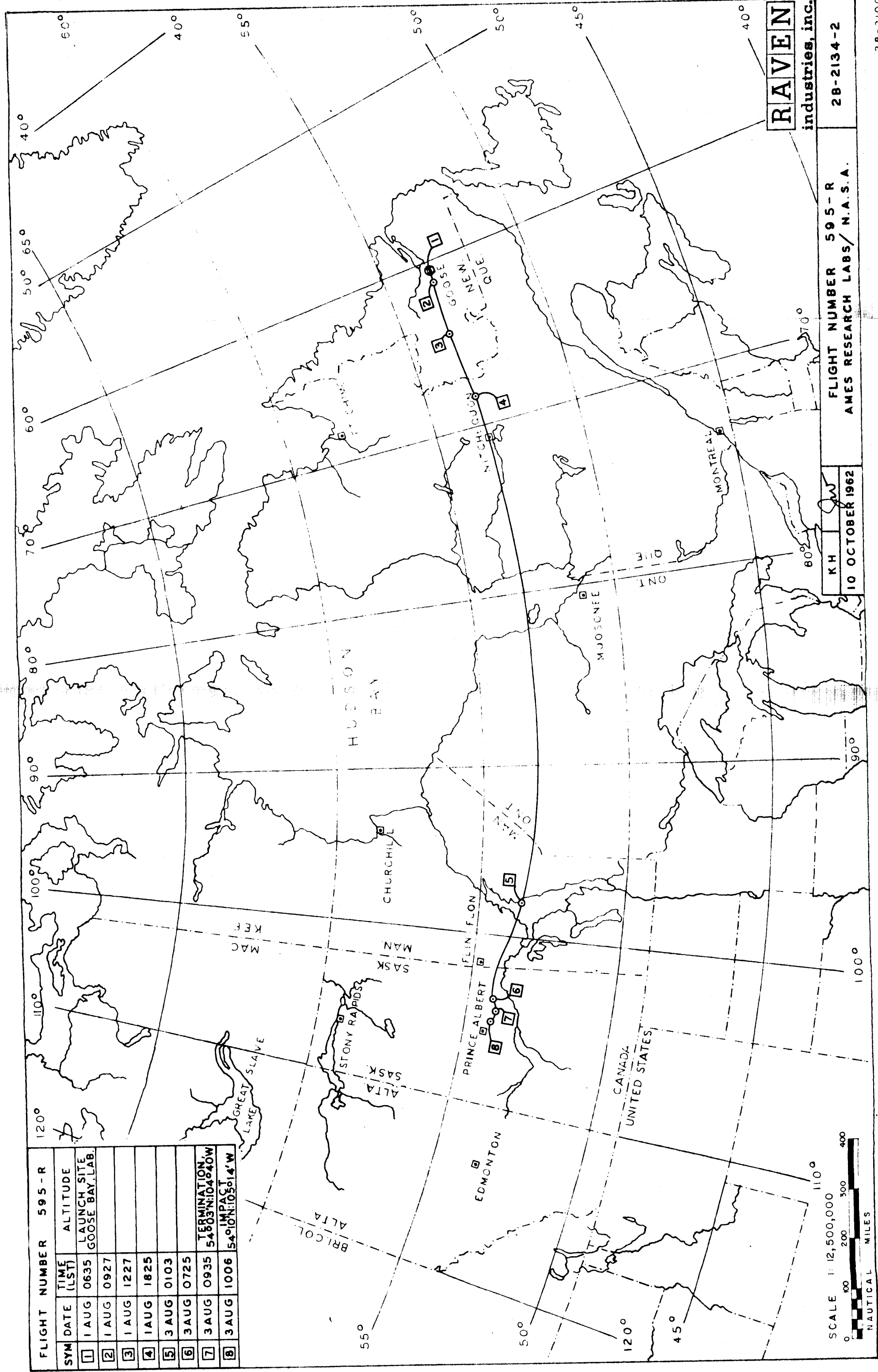


Figure 6

Close-up of the monkeys in their capsule couches immediately after being recovered. The boxes in front of the monkeys are food containers from which the animals can draw food while in flight. The upper half of the capsule lies alongside.

FLIGHT NUMBER 595-R		
SYM	DATE	TIME (LST)
1	1 AUG	0635
2	1 AUG	0927
3	1 AUG	1227
4	1 AUG	1825
5	3 AUG	0103
6	3 AUG	0725
7	3 AUG	0935
8	3 AUG	1006
LAUNCH SITE GOOSE BAY, LAB.		
TERMINATION, 54°03'N:104°40'W		
IMPACT 54°10'N:105°14'W		



RAVEN

industries, inc.

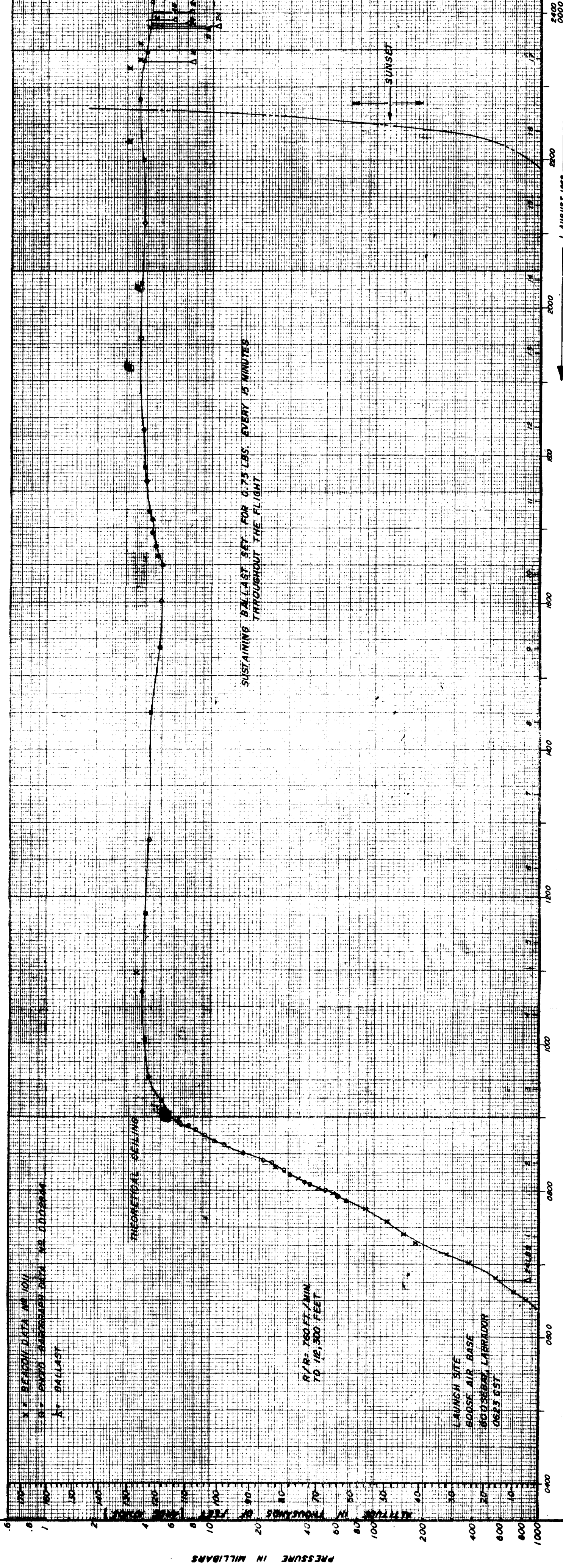
KH

10 OCTOBER 1962

FLIGHT NUMBER 595-R

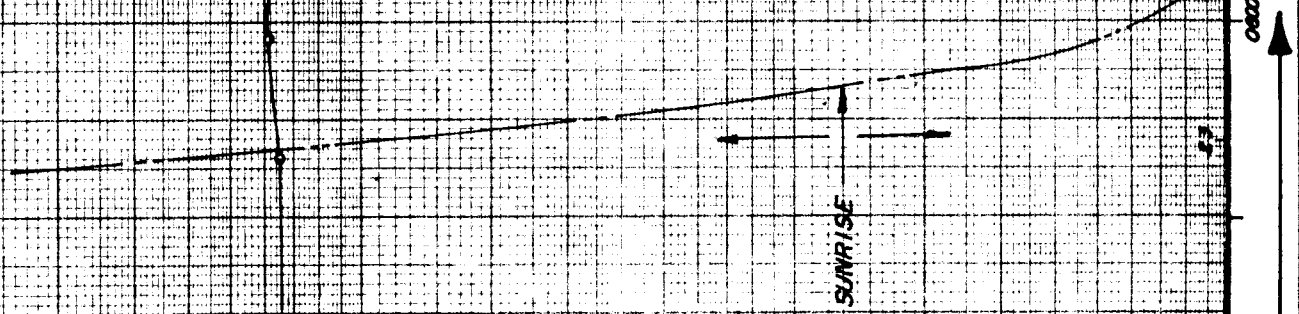
AMES RESEARCH LABS/ N.A.S.A.

28-2134-2



PRESSURE IN MILLIBARS

ALTITUDE IN THOUSANDS OF FEET
PRESSURE IN INCHES



FLIGHT NO. 595-R

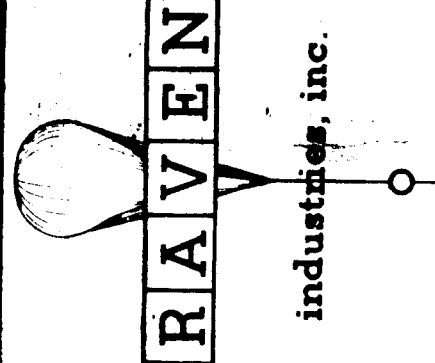
DATE: 1 AUGUST 1962
FOR: PROJECT 281
AMES RESEARCH
LABS
N. A. S. A.

BALLOON

TYPE: 2323-541-8291
VOL: 9 MILLION CU. FT.
MATL: 75 ML POLY
WT: 996.5 LBS

LOAD FACTORS

ANYLOAD: 1143.0 LBS
GROSS LD: 2139.5 LBS
FREE LIFT: 235 LB=11%
BALLAST: 400.0 LBS



DR. DOK 26 SEPTEMBER 1962
CHK. 45
APPR. PPK

2X-2092

PHOTO - BAROGRAPHY DATA
DISCONTINUED

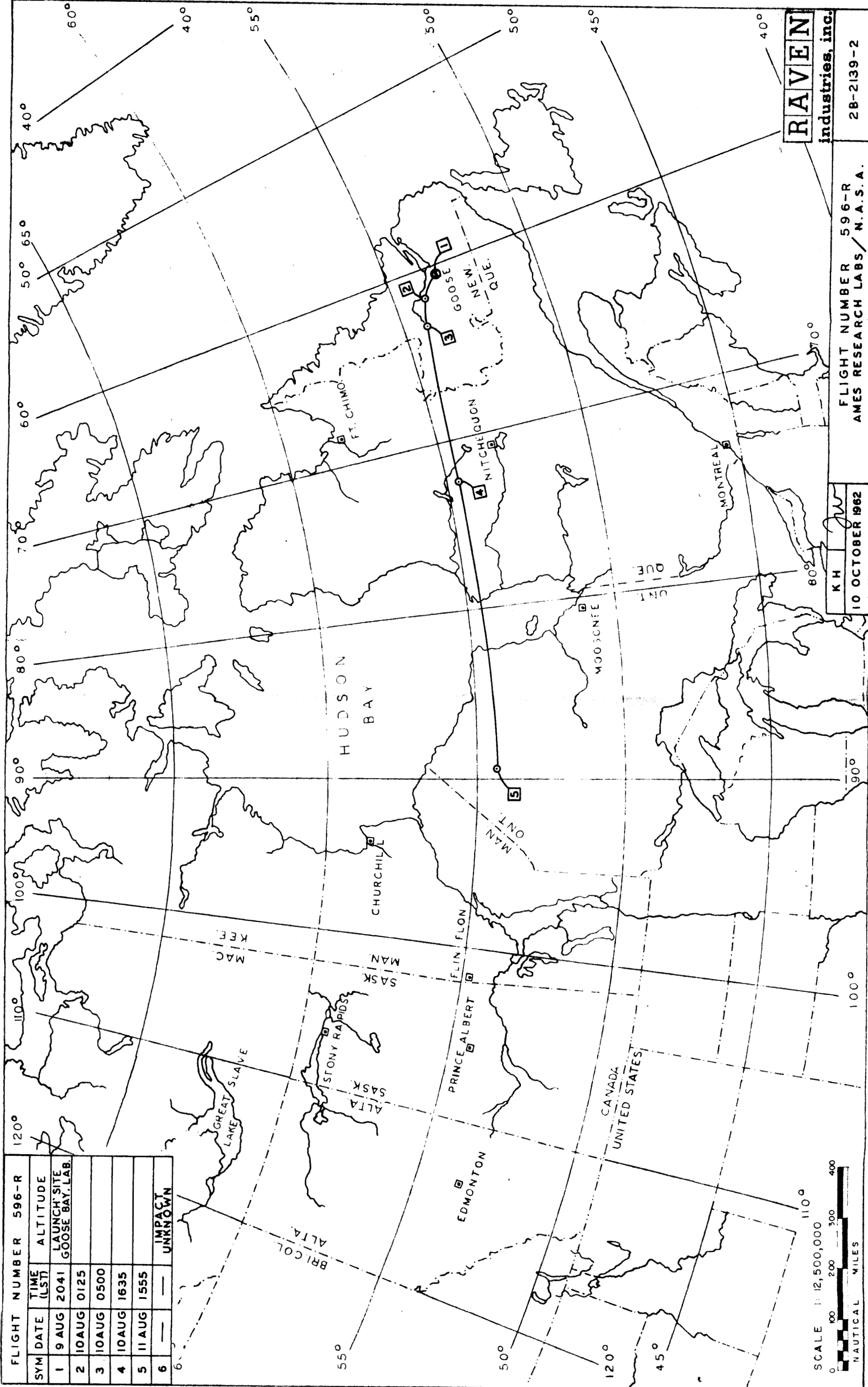
TERMINATION BY
RADIO COMMAND
0800 LST

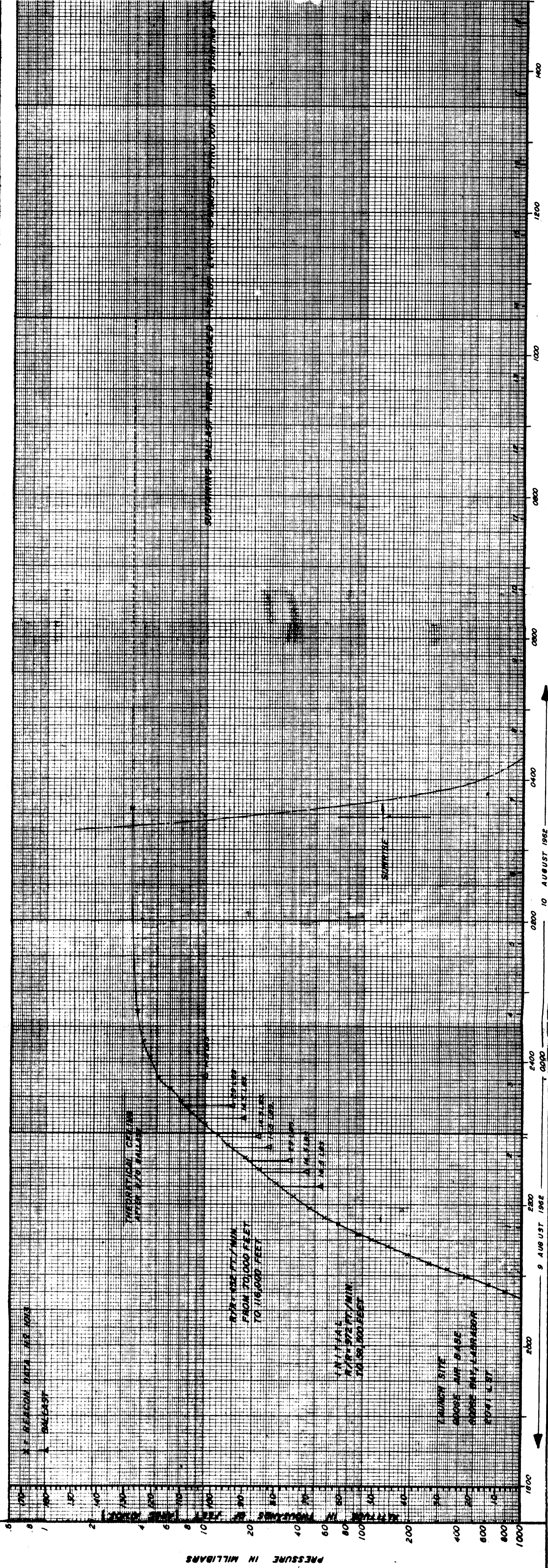
SUNRISE

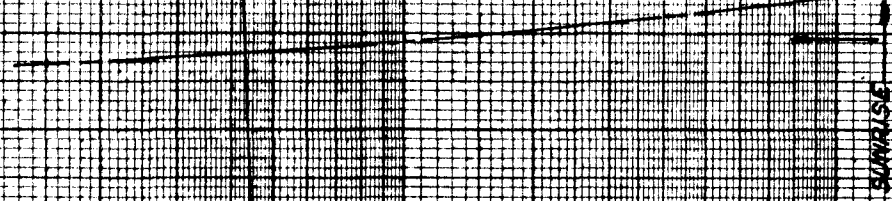
SUNSET

IMPACT AREA
54°-10' N
105°-14' W

FLIGHT NUMBER 596-R			
SYM	DATE	TIME (LST)	ALTITUDE
1	9 AUG	2041	LAUNCH SITE GOOSE BAY, LAB.
2	10AUG	0125	
3	10AUG	0500	
4	10AUG	1635	
5	11 AUG	1555	
6	—	—	IMPACT UNKNOWN







LEWIS

TIME 11 ST 0000 2400 0200 0400
" AUGUST 1969

8

FLIGHT NO. 596-R

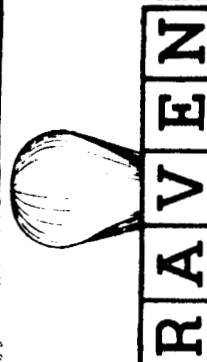
DATE: 9 AUGUST 1962
FOR: PROJECT 281
AMES RESEARCH
LABS
N. A. S. A.

BALLOON

TYPE: 2323-541-8291
VOL: 9 MILLION CU.FT.
MATEL: .75 MIL POLY
WT: 1008.5 LBS.

LOAD FACTORS

PAYLOAD: 1130.0 LBS.
GROSS LD: 2138.5 LBS.
FREE LIFT: 2781.8-13%
BALLAST: 400.0 LBS.



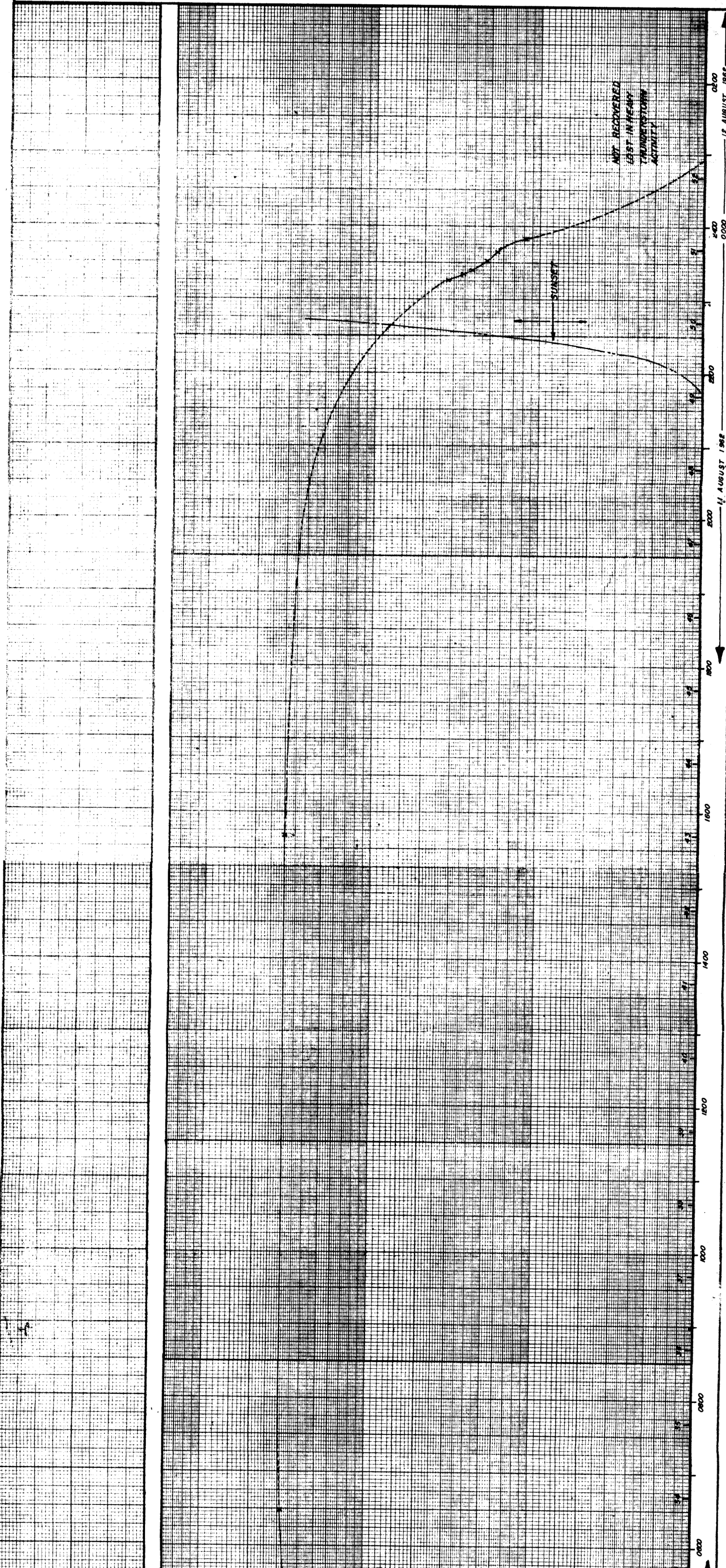
industries, inc.

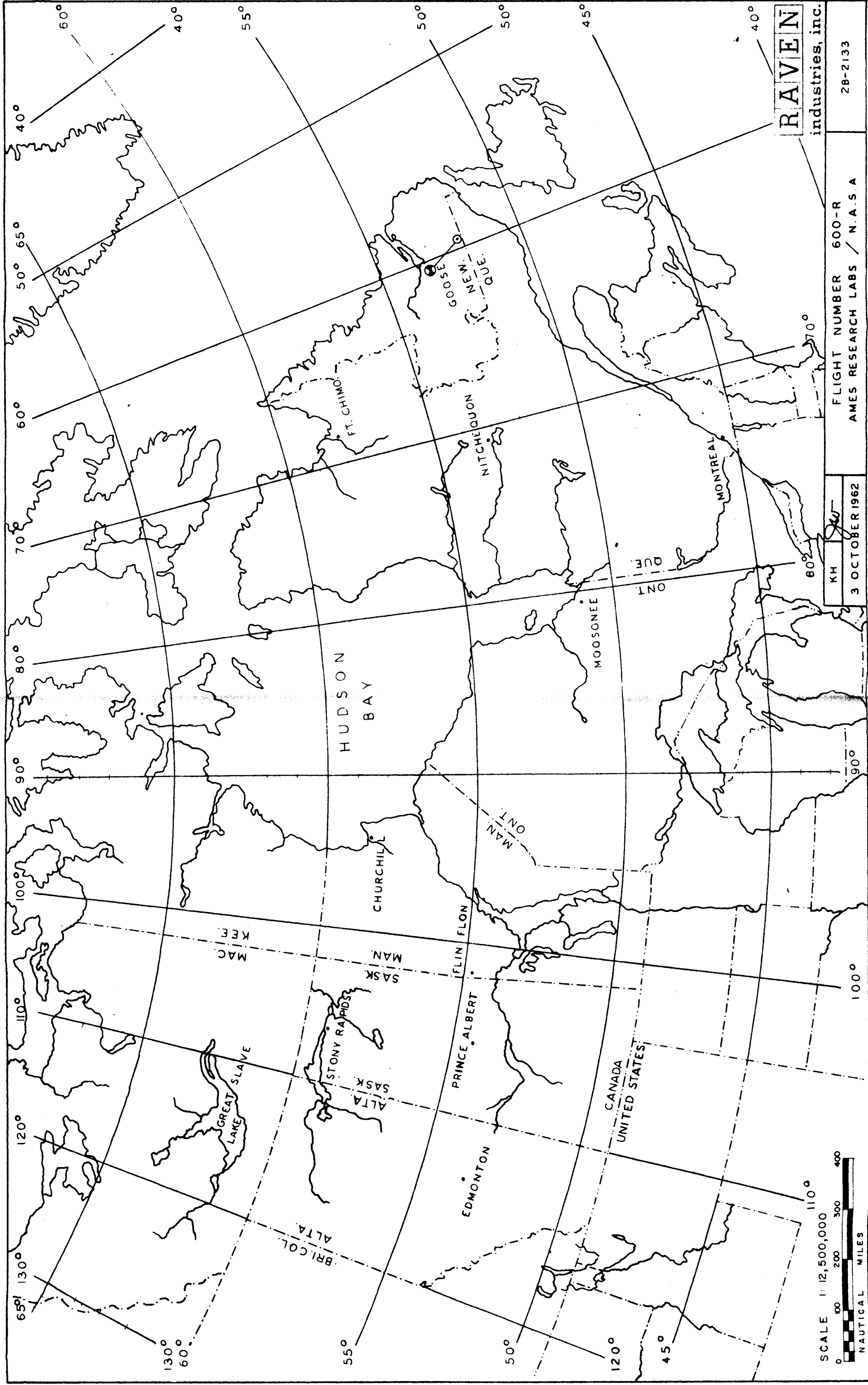
DR. DRK 26 SEPTEMBER 1962

CNK. *[Signature]*

APPR. *[Signature]*

2X-2094





FLIGHT NO. 600-R

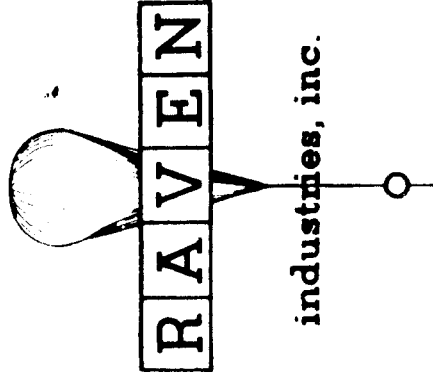
DATE: 16 AUGUST 1962
FOR: PROJECT 281
AMES RESEARCH
LABS.
N.A.S.A.

BALLOON

TYPE: 2323-541-8291
VOL: 9 MILLION CU. FT.
MATL: .75 MIL. POLY
WT: 985.5 LBS.

LOAD FACTORS

MYLOAD: 1066.0 LBS.
GROSS LD: 2051.5 LBS.
FREE LIFT: 286.7 LB-13%
BALLAST: 400 LBS.



DR. DCK 26 SEPTEMBER 1962

CHK. *[Signature]*

APP. *[Signature]*

2B-2093

X = BEACON DATA NO. 1000
A = BALLAST

PRESSURE IN MILLIBARS

TERMINATED BY
RADIO COMMAND
1324 LST

LAUNCH SITE
GOOSE AIR BASE
GOOSE BAY, LABRADOR
1124 LST

IMPACT AREA
52°-04'N
59°-26'W

ELAPSED TIME (HRS)

TIME LST

X. EXHIBITS

Annex A: Operations Plan 426-62

Provide billeting in VOQ #568 for approximately 24 male personnel and billeting in BOQ #565 for one female meteorologist for the period 6 July 1962 to approximately 15 August 1962.

Messing will be in the Officers Club.

Provide the following vehicles:

1. 1/2 ton pickup
2. Semi-trailer, tractor and driver (for departure and launch days only) .
3. Lowboy trailer (presently assigned BDCE, to be used on an as-needed basis during launch periods).
4. Fork lift and operator (launch days only) .
5. Base taxi service will be utilized except during launch periods when an additional personnel-carrying vehicle will be required.

The 4082nd DCM will:

1. Provide office space in the West Provisional Maintenance Squadron area, Hangar 14, for the Launch Team (Raven Industries, Mr. J.J. Kaliszewski).

This area will be vacated by the Launch Team during Base or higher Headquarters directed alerts.

2. Provide parking space in transient aircraft parking area for twin engine Aero Commanche. Servicing will be accomplished by civil agencies on Canadian side.

The 4082nd DSUP will:

1. Provide office space in building S-1090, Munitions Service area, for the Experimental Team.
2. Provide storage space in building S-1090 for capsules and allied equipment.
3. Provide an air conditioned room with hot and cold water in building S-1090 for housing of monkeys in ten (2 x 2 x 2) metal cages. Insure the air conditioning unit is functioning properly prior to 1 July 1962.
4. Direct the NCOIC, Munitions Service Branch, to properly brief the members of the Experimental Team on safety procedures in the Munitions area. No cigarette lighters, smoke in designated area, etc.

The Commander, 1623rd Support Squadron, will:

1. Provide storage area in Hangar 14 for six (6) balloons (4 x 4 x 8) on skids.
2. Provide outside storage, to the rear and west of Hangar 14, for the following equipment:
 - (a) Launch vehicle
 - (b) Tractor
 - (c) Trailer, helium
 - (d) Helium bottles

The Commander, 868 Medical Group, will:

1. Provide an ambulance with a medical corpsman and driver during all launch periods.

General Instructions:

1. The West Ramp will be utilized as the primary launch area. If weather and air traffic dictate, runway 04/22 will be utilized as a secondary area, with permission of the RCAF and coordination with agencies concerned.

2. The Wing Control Division will maintain close liaison with the DCO Project Officer during launch periods so as to be able to brief the Wing Commander, higher Headquarters and any SAC crews that may be flying during this period.
3. The DCO Project Officer will coordinate with the NASA Project Manager, RCAF and Canadian DOT to insure adequate and timely NOTAMS are dispatched and that all interested agencies are notified of all launches.
4. All necessary weather information will be furnished by the Canadian DOT, main meteorological office, through coordination with the NASA Project Manager and Commander, Det 14, 8th Weather Squadron.

Security:

1. Equipment on the flight line will be provided non-tactical security by Combat Defense Squadron patrol coverage.
2. The BDCL will contact the Project Manager upon arrival for the names of personnel and their clearance status for issue of temporary line badges or escort procedures, as applicable.

Sequence of Events:

1. Arrival of helium and helium tractor and trailer
on the McGraw- - 15 June 1962.
2. Arrival of Experimental Team - 6/7 July 1962.
3. Arrival of Launch Team - 6/9 July 1962.
4. Arrival of Monkeys, Capsules and Balloons -
6/9 July 1962.
5. First launch (2 balloons) 10/14 July 1962.
6. Second launch (2 balloons) 17/21 July 1962.
7. Departure of Equipment and Personnel - 1/15
August 1962.

It is anticipated that the NASA Project personnel will be on
Goose Air Base for approximately 30 days. Every effort
should be made to make their stay as enjoyable as possible.
Recreational facilities and service activities should be
geared to offer recreational outlets to these personnel.

The following personnel will be contacted for additional
assistance as may be required.

<u>Section</u>	<u>Name</u>	<u>Duty Phone</u>	<u>Home Phone</u>
DCO Project Officer	Capt. R. E. Birkenbuel	6112	3246

<u>Section</u>	<u>Name</u>	<u>Duty Phone</u>	<u>Home Phone</u>
Billeting	Capt. N. J. Lawrence	21105	21256
Transportation	MSgt. W. J. Vaught	6161	5325
NCOIC			
Munitions Br.	TSgt. J. E. Meyer	5191	6121
1623rd			
Support Sq.	Lt. D. F. Baker	21170	5258
Experimental Team		5191	
Launch Team		21168	

Administrative and Logistical Matters:

1. Administrative: Normal
2. Logistics: As Required

Command and Communicatians:

1. Command: Normal
2. Communications: Normal

S. F. Martin
Colonel, USAF
Commander

84p
N 64 81530

Code Name

Final Report
of Work Performed Under
Contract NAS2-871

for

National Aeronautics and Space Administration
Ames Research Center
Moffett Field, California

RAVEN

industries, inc.
Sioux Falls, South Dakota